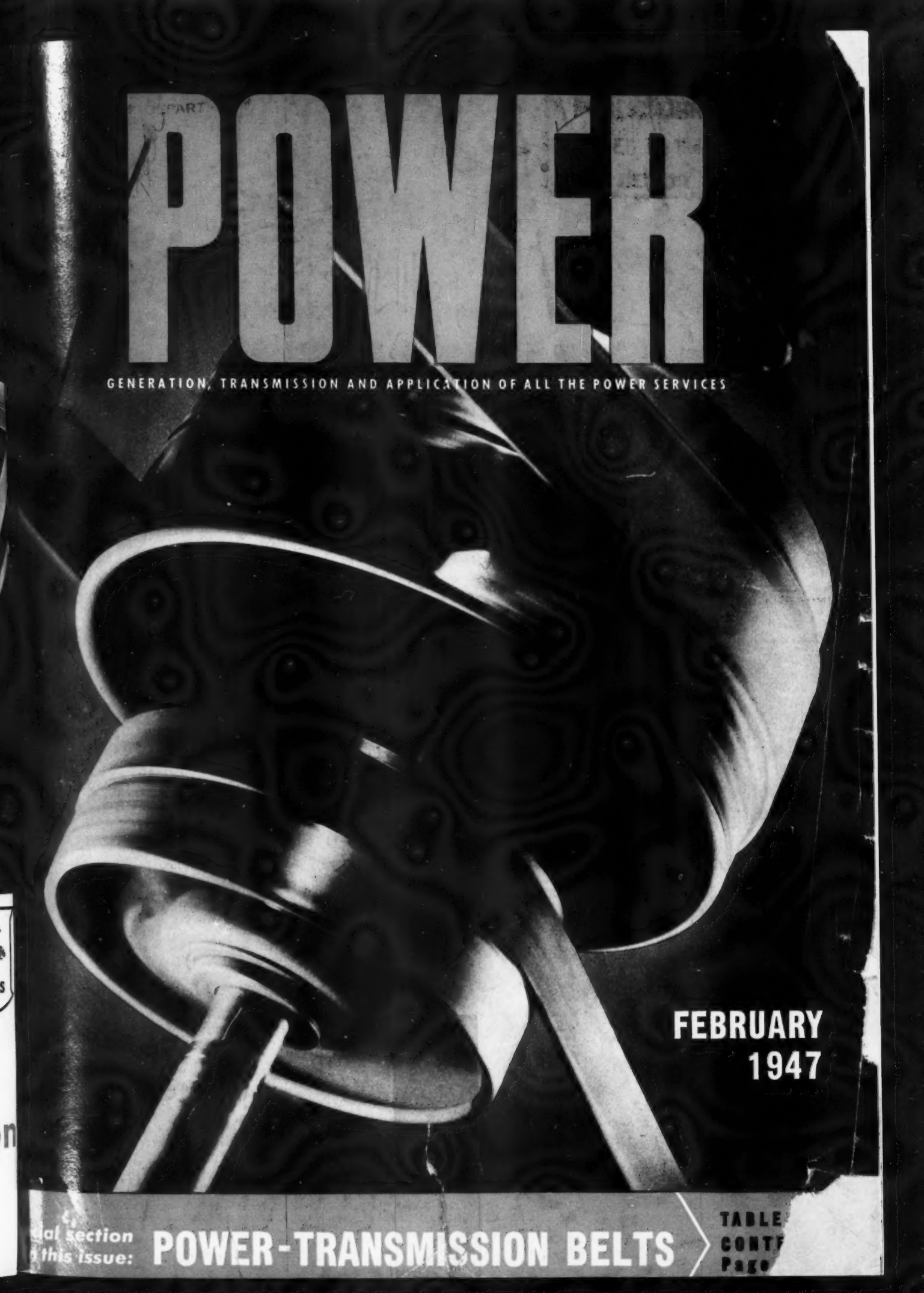
POWER

GENERATION, TRANSMISSION AND APPLICATION OF ALL THE POWER SERVICES



FEBRUARY
1947

Special section
in this issue: POWER-TRANSMISSION BELTS

TABLE
CONTE
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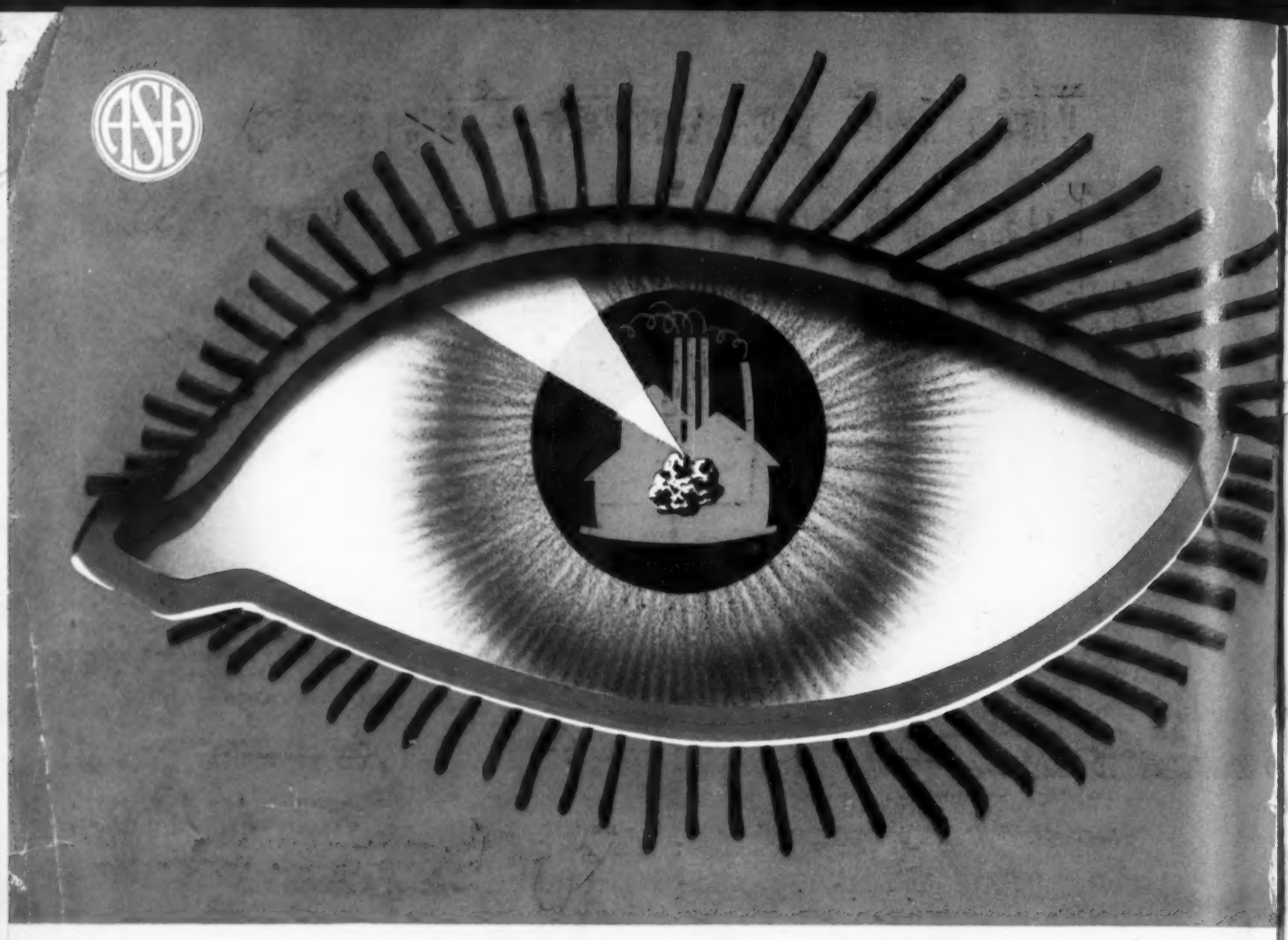


DUST HANDLING

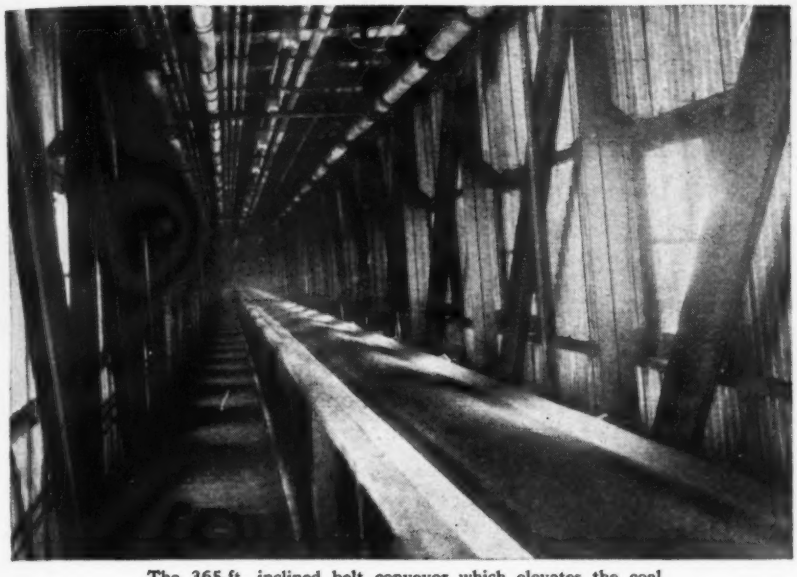
is as much a Problem in a Power Plant as In Your Eye

We believe you'll get as much relief in discussing your power plant dust removal problems with one of our engineers, as you secure with the experienced skill of an expert, when you have a dust removal problem in your eye. We have every modern method to offer, in fact, we developed them. Hydrovac or Hydromix Systems solve every dust removal problem and please bear this in mind: the new Automatic Hydrovac is not a time saving luxury; it's a cold cash necessity. The Allen-Sherman-Hoff Co., 227 S. 15th St., Philadelphia 2, Pa.

ALLEN • SHERMAN • HOFF CO

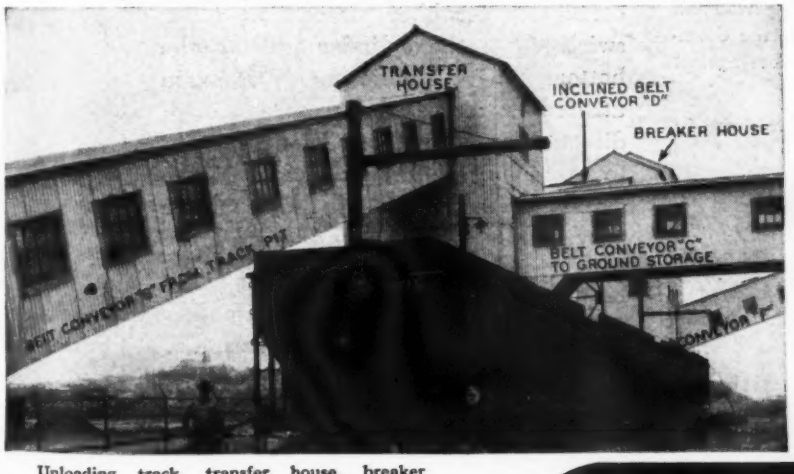
Engineer," "The Stationary Engineer," Founded 1910. Vol. No. Published monthly at 29-129 N. Broadway, Albany 1, N. Y. Editorial and executive offices, 327 W. 42nd St., New York ch 3, 1879. Printed in U. S. A. Allow at least 10 days for change of address. All communi- St., New York 18, N. Y. Subscription rates, U. S. and U. S. possessions, for one year, $8 for merica, $10 for one year, $16 for 2 years. All other countries $15 for one year, $25 for two

This L-B Conveyor Can Take 350 Tons of Coal "Upstairs" per Hour



The 365-ft. inclined belt conveyor which elevates the coal from the breaker-cleaner at trackside to gallery over silos.

This 100,000-Kw generating station uses a Link-Belt conveyor system with a present capacity 350 T.P.H.; ultimate 700 T.P.H.



Unloading track, transfer house, breaker house and conveyor galleries B, C, D and F.

10,401

Series of 7 Belts Handles Coal for Large Generating Stations

To move 350 tons per hour of run-of-mine bituminous coal through the various steps from railroad cars to the huge silos which feed this 100,000-Kw generating station is a real job! The L-B Belt Conveyor system as installed, supplies that quantity with a belt speed of 300 F.P.M. It can be operated up to 600 F.P.M. if ever necessary.

A. A 22-ft. cross conveyor belt takes coal from track hopper to 166-ft. inclined belt B.

B. This belt conveyor (see lower view) carries coal over a continuous weighing scale, discharging over a magnetic head pulley (which collects tramp iron), delivering either to belt C or D.

C. A 65-ft. stocking-out conveyor belt at right angles to centerline of B leads to reserve ground storage pile.

D. This 178-ft. inclined belt conveyor discharges into a breaker which reduces coal to proper size and takes out non-magnetic objects.

E. A short, inclined belt receives coal from breaker-cleaner and delivers it to the inclined belt conveyor F shown in top view.

F. This 365-ft. link in the system takes the coal to a conveyor gallery over the six 250-t n silos. A side view of conveyor F appears in center picture.

H. A shuttle belt conveyor mounted on movable steel frame, may be motor propelled over all six silos. Coal from belt F is thus delivered to silos, from which it goes to pulverizer and thence to furnace.

Whatever type of conveyor is indicated for your situation, Link-Belt engineers can give you a practical, economical solution.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

LINK-BELT

THE SYMBOL OF QUALITY — L-B — LINK-BELT

BELT CONVEYOR EQUIPMENT

IDLERS • TRIPPERS • BELTS • PULLEYS • BEARINGS • DRIVES

cleaner, drier steam from

Elimination of solids and moisture from steam leaving boiler drums, and an assurance of positive boiler water circulation, are accomplished with an unusual degree of effectiveness by the B&W Cyclone Steam Separator. Seven years of wide use in Babcock & Wilcox boilers have thoroughly proved the efficiency of the B&W Cyclone Steam Separator for the consistent and reliable production of clean, dry steam.

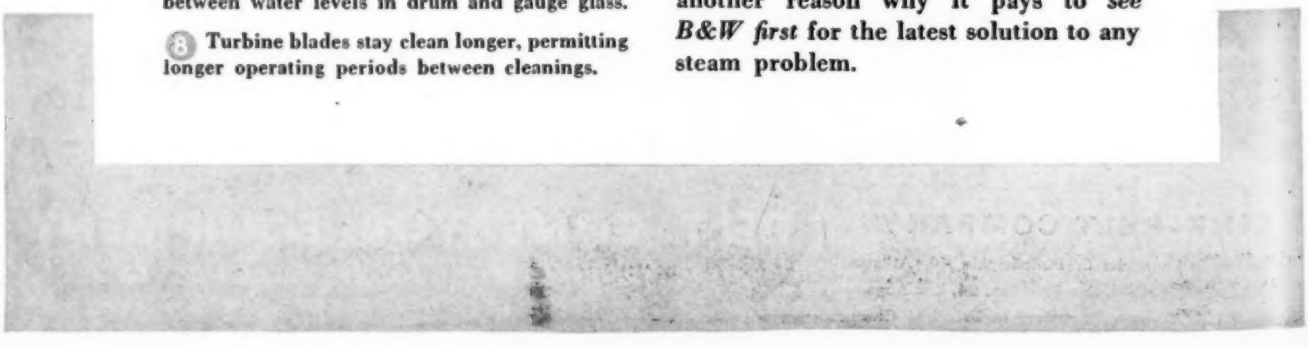
WHAT THE CYCLONE DOES:

The separation of the water and its attendant solids from the steam is so nearly complete in the Cyclone Steam Separator that boiler and turbine performance are improved in many important ways:

1. Boilers can be operated at greater water-level variation without priming, making larger and more rapid load swings safely possible.
2. Complete separation of the steam from the water produces a maximum circulating head and delivers solid (steam free) water to the downcomers, thereby protecting boiler tubes against overheating and burnout.
3. Dry steam is assured over wider range in boiler water concentration.
4. Superheater tubes are protected from burnouts and failure due to scale deposits.
5. Longer periods of continuous boiler operation are secured.
6. Savings in maintenance time and expense are effected in boilers and turbines.
7. Safety is promoted by reducing variations between water levels in drum and gauge glass.
8. Turbine blades stay clean longer, permitting longer operating periods between cleanings.
9. Desired KW output can be maintained for longer periods.

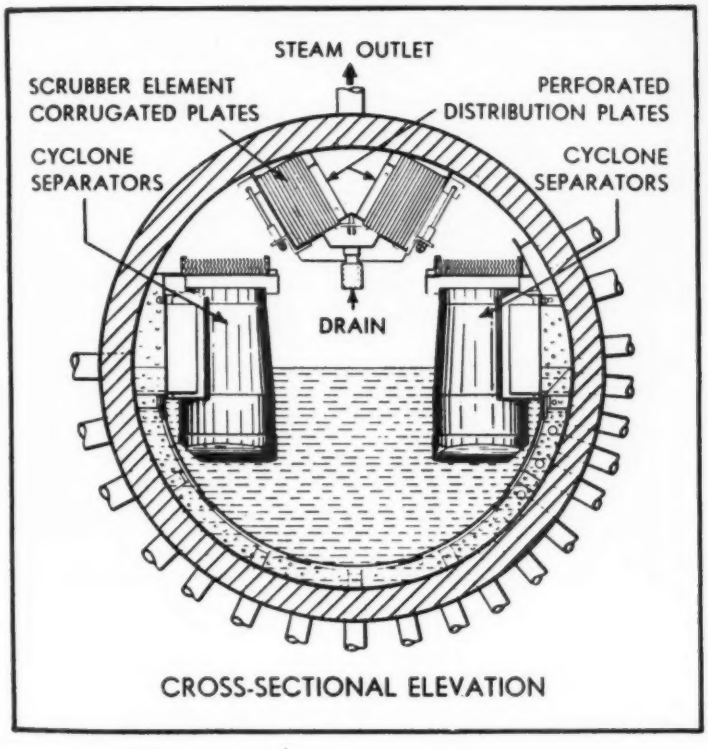
Separation of the water from the steam by the Cyclone Steam Separator is a continuous action. The kinetic energy of the steam and water mixture entering the Cyclone forces the water and any entrained impurities to the wall of the cylinder, while the nearly pure, dry steam passes out at the top between corrugated scrubber plates. The water swirls down the cylinder wall to the bottom, where kinetic energy is again utilized to force the water through directing vanes with sufficient velocity to overcome the head of water in the drum. The action within the separator prevents its flooding, and assures the delivery of clean, dry steam at all times.

The Cyclone Steam Separator is another B&W "first" in the development of better steam-generating equipment — another reason why it pays to *see B&W first* for the latest solution to any steam problem.

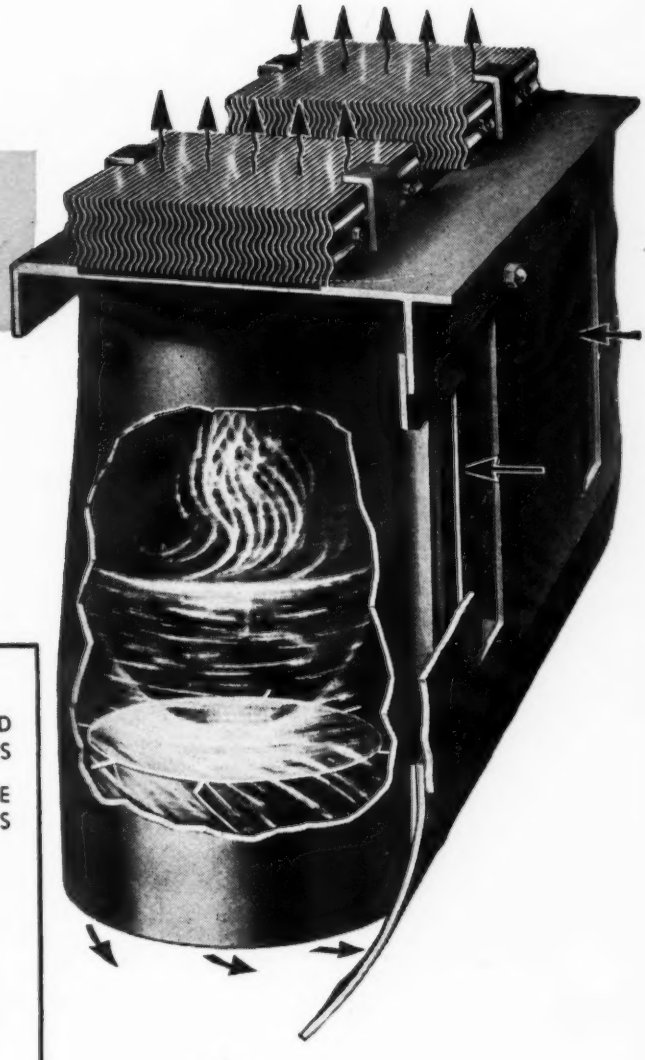


a cyclone...

Cross section of typical Cyclone Steam Separator installation in a large boiler drum.



CROSS-SECTIONAL ELEVATION



B&W Cyclone Steam Separator with section cut away to show functioning.

Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

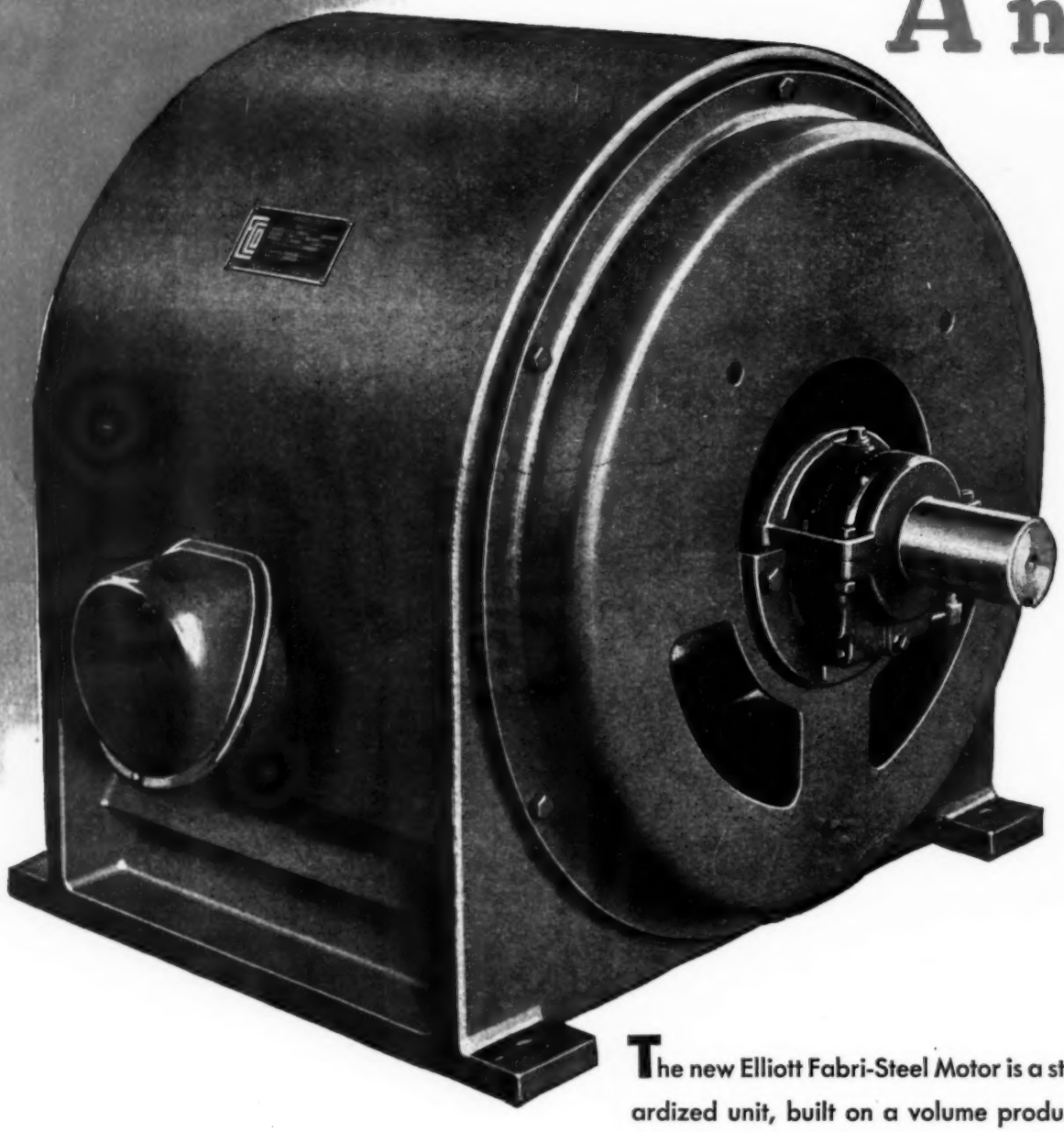
BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
85 LIBERTY STREET, NEW YORK 6, N.Y.

G-284T

A new a

T



The new Elliott Fabri-Steel Motor is a standardized unit, built on a volume production scale. Five frame diameters cover all standard ratings from 150 to 1000 hp, 4 to 14 poles. Dripproof sleeve bearing squirrel-cage induction type illustrated above.

Elliott

and better motor is born . . .

THE Elliott FABRI-STEEL Motor

ELLIOTT ENGINEERING has applied all that it has learned through a broad use of electrically welded fabricated steel, plus an equally broad experience in top-quality motor construction, to the development of the new Elliott "Fabri-Steel" motor.

The result is a motor engineeringly beautiful in appearance, obviously practical in application, with the following outstanding advantages:

NEW LOW MAINTENANCE

- A split sleeve bearing arrangement which for the first time makes it unnecessary to remove the upper half of the end-bell to get at a bearing. On the Fabri-Steel motor the bearing cap only need be removed for bearing inspection—
- Bottom half of bearing can be removed by rolling it out, provision being made to take the load off the bearing by external means—
- After the bearing housing is removed, openings permit withdrawal of coupling without removing coupling from shaft—
- Standardized parts, precision built to close tolerances, permit carrying of spare parts in users' stockrooms for quick replacement and renewal of operation.

NEW HIGH PERFORMANCE

- Elimination of destructive vibration by extreme rigidity of welded steel construction provides longer bearing life and quietness—
- More uniform air gap, because of integral rigid stator assembly with end plates and bearing brackets precision machined with special jigs and fixtures—
- Bearings that will stand rougher treatment, because of thinner, more rigidly supported babbitt liner, with bronze bearing shell that provides closer bond between liner and shell.

These are only a few of many highlights covered in full in the Fabri-Steel Motor Bulletin, now in preparation.

L-770

COMPANY

Electric Power Dept., RIDGWAY, PA.

Plants at: JEANNETTE, PA. • RIDGWAY, PA.
SPRINGFIELD, O. • NEWARK, N. J.

DISTRICT OFFICES IN PRINCIPAL CITIES

STEAM TURBINES • GAS TURBINES • GENERATORS
MOTORS • CONDENSERS • FEEDWATER HEATERS
AND DEAERATORS • STEAM JET EJECTORS
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES
TUBE CLEANERS • STRAINERS • DESUPERHEATERS • FILTERS

With DIAMOND AUTOMATIC

JUST PUSH A BUTTON

and the Automatic Control makes sure that all Soot Blowers operate in Proper Sequence and at the Right Speed . . . none can be overlooked. CORRECT CLEANING IS ASSURED AND BOTH FEED WATER AND LABOR ARE SAVED.

Just push a button . . . that's all you do to clean the entire boiler, superheater, economizer, and air heater (whether soot blower elements are fixed or retracting). All blowers then operate in proper sequence and at the correct blowing speed. No blower can be overlooked or incorrectly operated by a careless operator. This automatic operation entirely eliminates the need for an attendant.

The program panel shown above controls both retracting and nonretracting blowers arranged in three groups; any desired number of groups can be had when system is designed. One "start" button controls all groups, but any group can be operated independently of other groups if desirable by simply throwing a switch on the panel. Blowing sequence of the units in any group can also be easily altered to suit changed conditions.

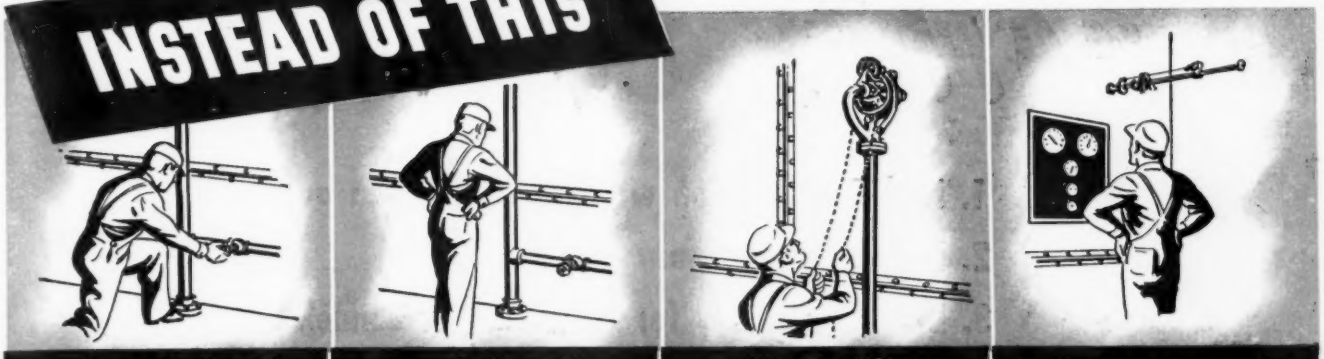
Compressed air has a greater density than steam and therefore provides better cleaning. The air is discharged from permanently installed elements (see bottom of right-hand page) in a series of short puffs with substantial pauses between. Spreading the cleaning cycle over a longer period of time eliminates stack discharge nuisance and permits use of a much smaller compressor.

Diamond Automatic Sequential Air Soot Blowing Systems have been in very successful central station use since 1940. For further information, write for Bulletin No. 956 which illustrates and describes an installation on a 900,000 lb/hr boiler in a modern eastern central station.

DIAMOND POWER SPECIALTY
DIAMOND SPECIALTY

SEQUENTIAL AIR SOOT BLOWING

INSTEAD OF THIS

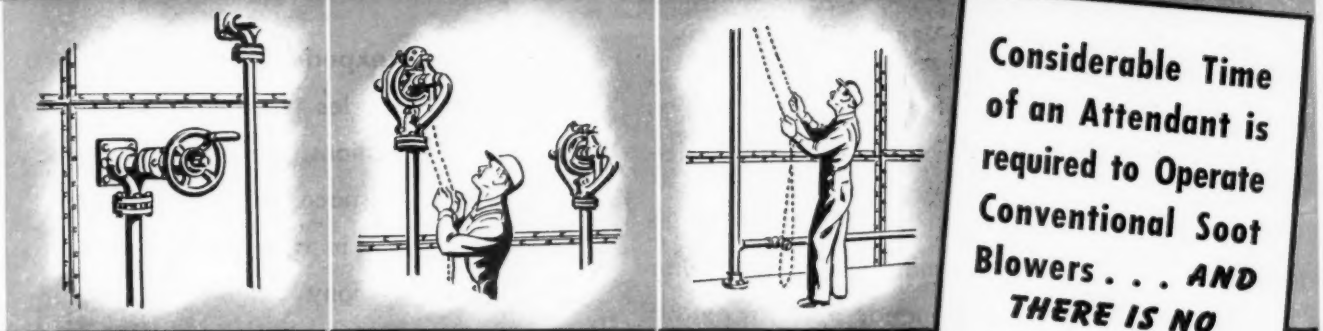


1 Opens Drain and Main Steam Valves

2 Drains and Warms Up Piping

3 Operates Blower No. 1 Too Fast

4 Operates Long Retracting Blower No. 2



5 Forgets to Operate Blower No. 3

6 Operates Blowers No. 4, 5, etc.

7 Closes Main Steam Valve

Considerable Time of an Attendant is required to Operate Conventional Soot Blowers . . . *AND THERE IS NO ASSURANCE THE WORK WILL ALWAYS BE CORRECTLY DONE!*

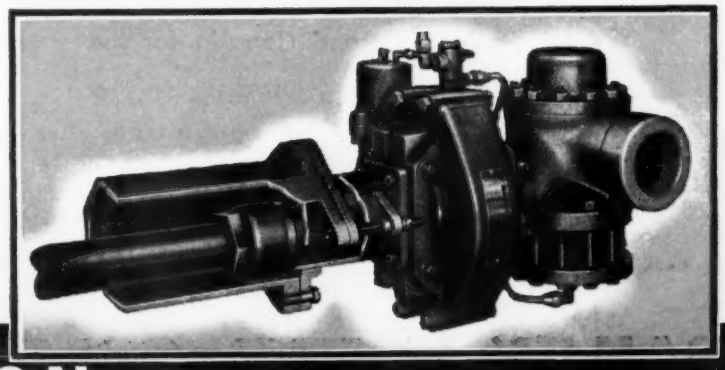
OTHER ADVANTAGES of DIAMOND Automatic Sequential AIR SOOT BLOWERS

NO FEED WATER MAKEUP—Using compressed air instead of steam as the cleaning medium, there is no condensate loss due to soot blowing. This is particularly important where makeup water is a problem.

SAVES FUEL—Experience gained during several years' operation on a number of installations indicates that automatic sequential air puff soot blowing uses only ⅕ to ⅗ of the energy from the coal pile that is needed for steam blowing.

REDUCES MAINTENANCE—Experience on two 900,000 lb/hr boilers placed in operation in 1940 and one 900,000 lb/hr and one 550,000 lb/hr units installed in 1942 has proved the maintenance cost is unusually low.

ELIMINATES PIPING INSULATION—When air is used for cleaning, the soot blower piping is not insulated.



At right is the Diamond Air Puff Soot Blower having element permanently installed inside the setting; various types of retracting soot blowers are also used in the Diamond Automatic Sequential Air Soot Blower System.

CORPORATION • DETROIT 31, MICHIGAN

LTD., Windsor, Ontario

Here are the benefits you get from

BAILEY CONTROLS

1. **Fuel Conservation without decrease in output.**
2. **Lower Cost Steam.**
3. **Increased Safety for Plant and Personnel.**
4. **Better Power Service.**

Bailey Controls for boilers make the important factors of steam plant operation work together to insure ideal performance.

In order that all of these factors may be regulated in harmony with each other and the load demand, Bailey Controls are carefully engineered to the requirements of the units which they serve.

Bailey engineering service starts with the selection of suitable metering and control equipment and continues through the design, construction, calibration, installation and final adjustment on the job. Bailey field engineers are stationed in over thirty industrial areas throughout the United States and Canada for the purpose of rendering prompt "on the spot" engineering service without undue traveling expense.

The Bailey engineer in your community has extensive experience at his command, which includes tests on thousands of boiler installations, covering a wide range of fuels, furnaces and fuel burning equipment. He is in a position to help you secure the many benefits resulting from intelligent use of correctly selected and properly applied boiler control.

Bailey Controls for boiler operation are described in Bulletin 15-C. Write for your copy to Bailey Meter Company, 1036 Ivanhoe Road, Cleveland 10, Ohio —in Canada to Bailey Meter Company Limited, Montreal.

FUEL CONVERSION

If it becomes desirable or necessary to convert to another fuel, Bailey Controls can be adjusted easily to insure optimum results from the new fuel.

G-26

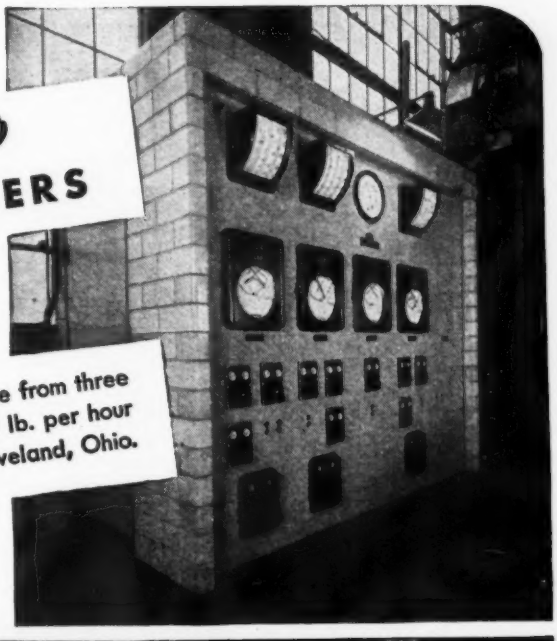
BAILEY METER COMPANY

1036 IVANHOE ROAD • • • CLEVELAND 10, OHIO

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

Controls for Steam Plants

APPLICATION to STOKER FIRED BOILERS

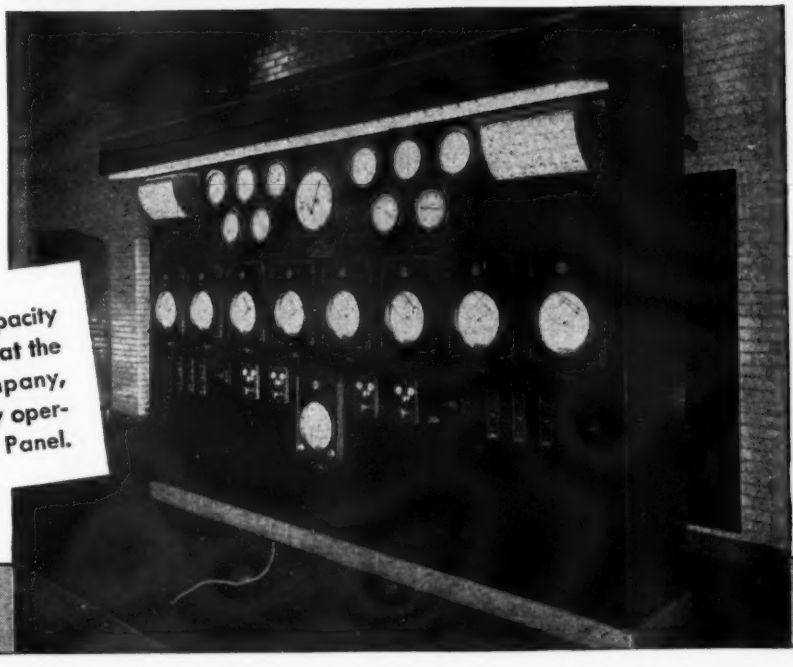


UNDERFEED

This Bailey Control Panel insures optimum performance from three underfeed stokers on two 25,000 and one 40,000 lb. per hour capacity boilers at Parker Appliance Company, Cleveland, Ohio.

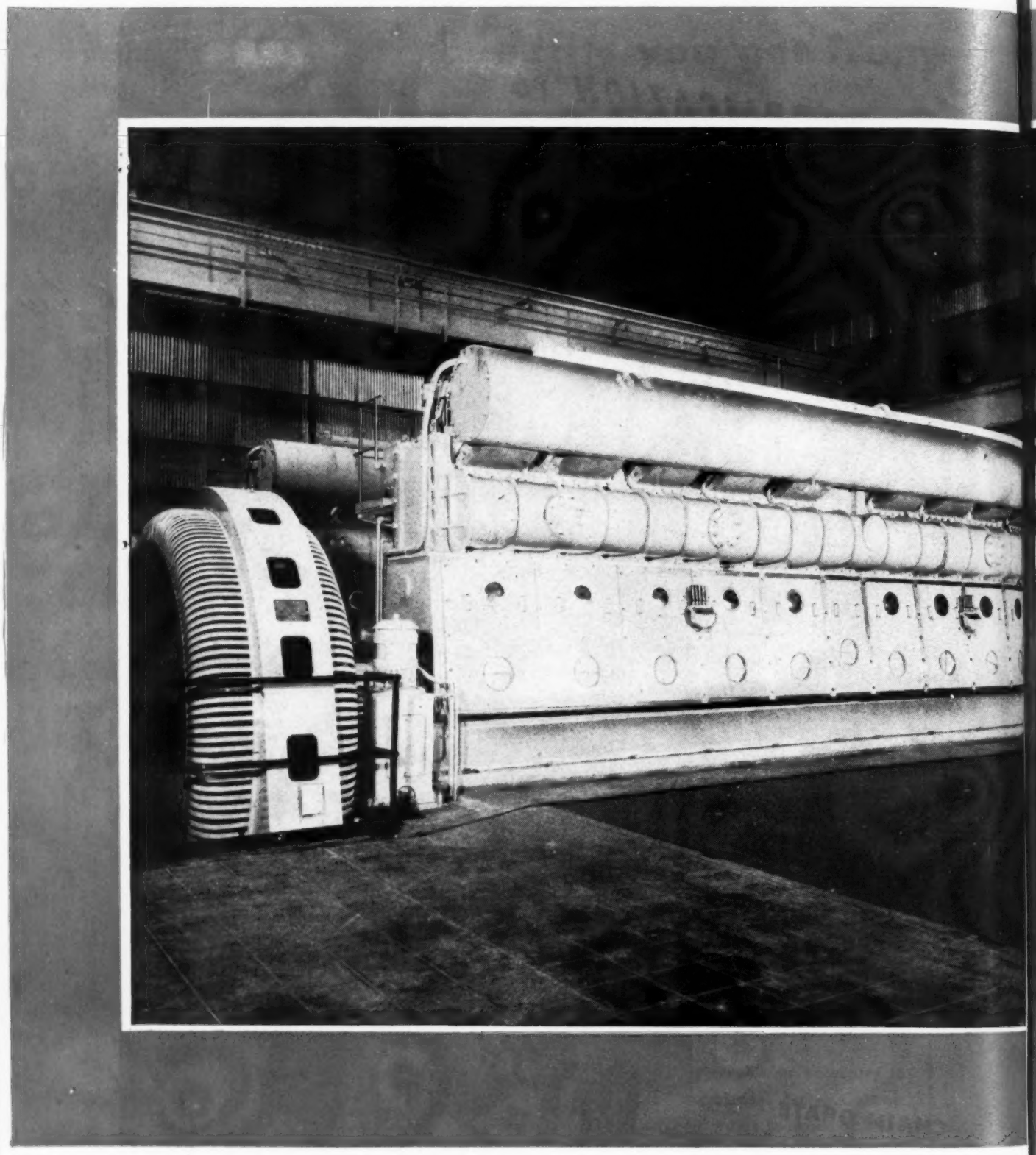
SPREADER

Bailey Controls help operators at Graham-Paige Motors Corporation, Detroit, Michigan, to maintain tests standards in everyday operation of this 60,000 lb. per hour boiler fired by a spreader type stoker.



CHAIN GRATE

Two 40,000 lb. per hour capacity chain grate stoker fired boilers at the United States Tobacco Company, Chicago, Illinois, are efficiently operated by this Bailey Control Panel.



Tune in . . .
TEXACO STAR THEATRE
presents the NEW
EDDIE BRACKEN SHOW
every Sunday night.
Metropolitan Opera
broadcasts every Saturday
afternoon.

TEXACO

TEXACO

Keep Diesel Efficiency High

OPERATING COSTS LOW

EFFECTIVE Lubrication means real economy in Diesel operation. Use *Texaco Ursa Oils* and note the savings you can make in operating and maintenance costs.

Texaco Ursa Oils keep engines clean and powerful—strongly resist oxidation, protect bearings, lubricate effectively under the high temperatures and pressures. They assure minimum wear of pistons, rings, liners and bearings longer, more economical service between overhauls —*low fuel consumption!*

Texaco Ursa Oils are approved by all leading Diesel manufacturers, and assure the most efficient operation of every type and size of Diesel. Because of their proved effectiveness—

More stationary Diesel hp. in the U. S. is lubricated with Texaco than with any other brand.

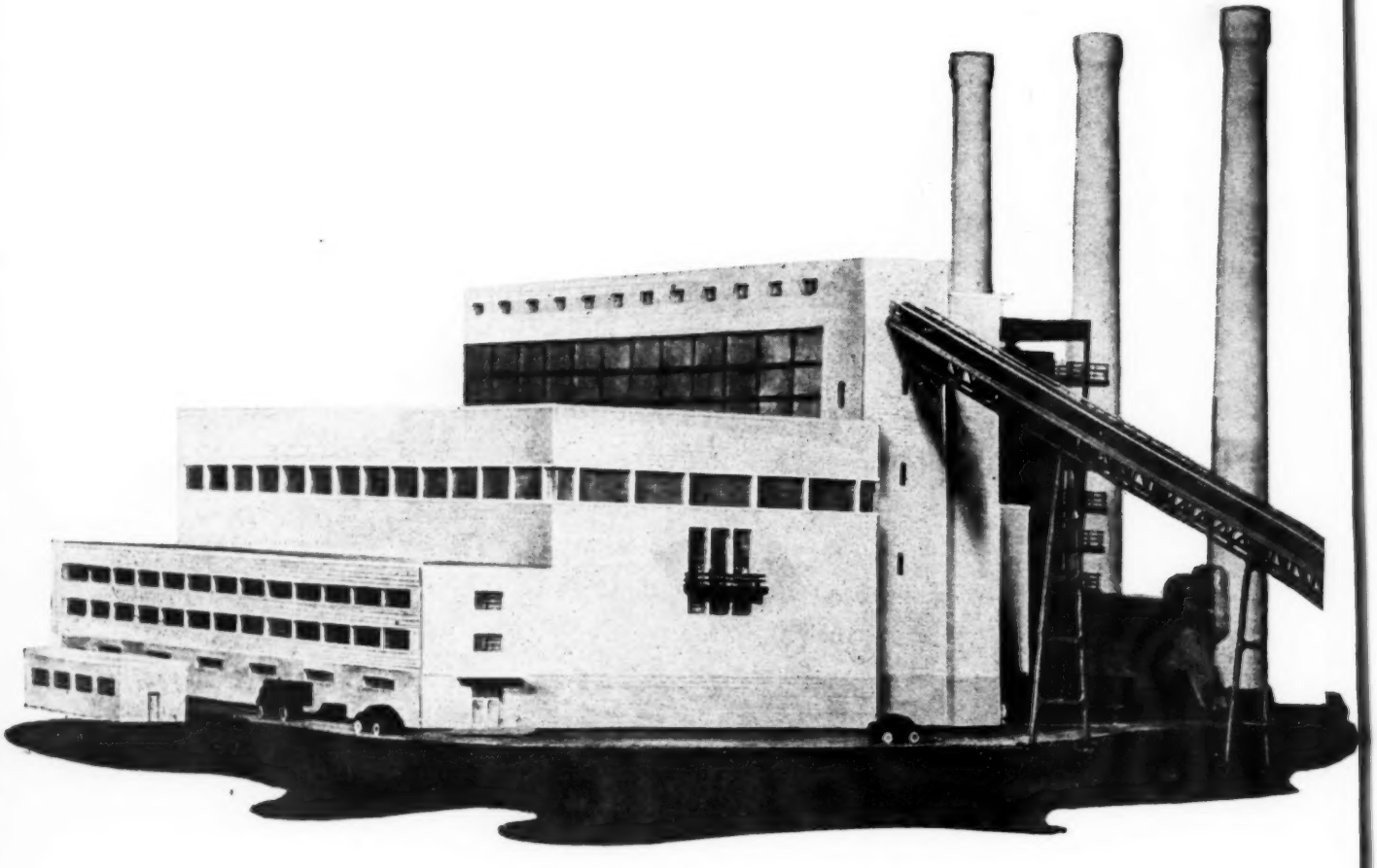
For Texaco Products and Lubrication Engineering Service, call the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

URSA OILS

FOR ALL DIESEL ENGINES

Sewaren

C-E "Outdoor" Units



Model of the new Sewaren Station as it will appear on completion of the first section. A partial view of the operating platforms and steel supporting structure of the semi-outdoor steam generating units can be seen at the right.

COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

GOES TO 1050° STEAM

a feature of this new station

Indicative of today's thinking on utility plant design is Sewaren Station, newest addition to the Public Service Electric and Gas Company system at Sewaren, New Jersey.

The first section of this station will comprise three 100,000 kw turbine-generators each served by a C-E Steam Generating Unit supplying steam at a throttle pressure of 1500 psi and at a temperature — for the *first* time in power station practice — of 1050 F.

Of further interest and significance is the fact that at Sewaren — for the first time in this climate and for units of this size — the steam generating equipment will be of the semi-outdoor type.

The unit arrangement is employed, in which each turbine is served by its own boiler without cross-connecting piping.

ENGINEERING

200 MADISON AVENUE, NEW YORK 16, N. Y.

This team works for thousands

One of several high pressure Reliance Alarm Water Columns in a prominent N.Y. State public utility power plant.

Reliance **EYE-HYE** *is mounted in a prominent position on instrument panel for each boiler, handy for observation at all times.*

Since 1884

Reliance

of power plants like yours

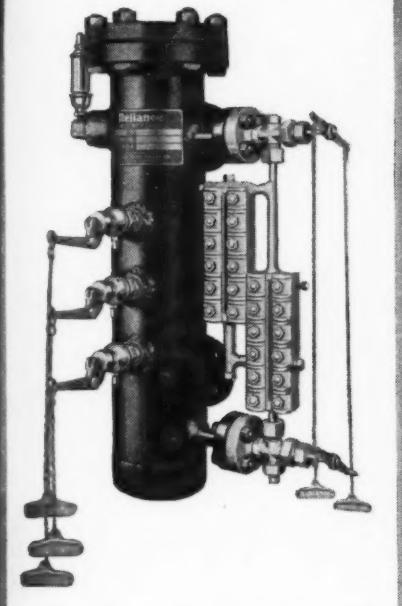
Double checks boiler water levels—helps you achieve more efficient operation, lower power cost, greater safety

● Of all the factors requiring constant careful checking in your power plant, the boiler water level remains one of the most important. In spite of careful employee training and frequent warnings, low water level is still a common cause of serious boiler damage. The Reliance Safety Team has been on the job for years in many plants . . . supplying a reliable double check to prevent accidents and costly boiler outage.

Up on the boiler drum the Reliance ALARM sounds instant warning when levels go too low—or too high—by shrill whistle or by electric signals. EYE-HYE carries the true water level reading, in brilliantly illuminated green indication, to convenient positions on the boiler room floor or remote control panel. It's read at a glance, saves time, induces frequent checking.

Don't take chances on power failure when Reliance Safety Team gives you the means of adequate water level supervision. And better supervion helps you to keep fuel costs down, gives you more capacity through consistent operation.

Write for ALARM and EYE-HYE bulletins—there's no obligation, of course!

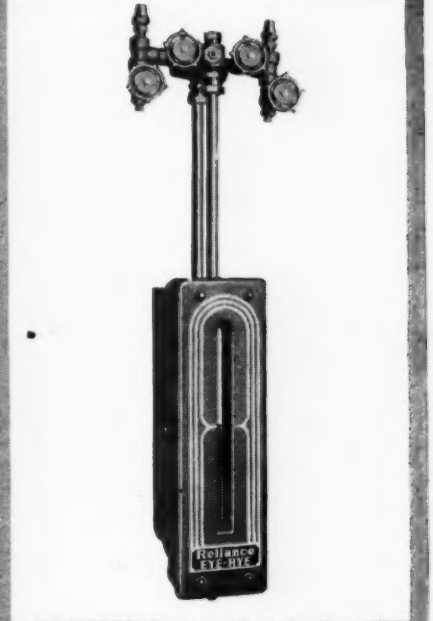


Reliance Alarm Water Columns

The ALARM is your reliable SOUND check, standing guard at the boiler drum. Its sensitive mechanism responds instantly—signalling when water levels reach within ¼ inch of predetermined signal points. Its rugged construction assures trouble-free operation and a life as long as the boiler's.

Reliance EYE-HYE

The modern SIGHT check for water levels, EYE-HYE brings water level reading down to an eye-level position, on wall or instrument panel. It's accepted in some codes as the *second* gage where two gages are required on higher pressures. Positive hydrostatic operation—as simple as the usual water gage.



Known the world over for accuracy, sturdiness and dependability, there's a Reliance Water Column for every type of boiler—any pressure—and gage equipment for every water level checking need. Reliance is the oldest exclusive boiler safety devices manufacturer. Representatives in all principal cities, or write the factory for catalogs and information.

BOILER SAFETY DEVICES

THE RELIANCE GAUGE COLUMN CO.
5902 Carnegie Ave., Cleveland 3, Ohio

FIRST PUBLIC ANNOUNCEMENT

OF THE Æ

PERFECT SPREAD STOKER

WITH CONTINUOUS ASH DISCHARGE

Also Available With Stationary Grates and Dumping Grates

MORE STEAM AT LOWER COST

Now, to all the exclusive features that have made the Perfect Spread Stoker the talk of operators, we have added a New Continuous Ash Discharge. While this is the first public announcement, the New Stoker is already in operation and our plant is going at top-speed to meet the snow-balling demand.

From coal hopper to ash pit the Æ Perfect Spread Stoker, with Continuous Ash Discharge, is designed to give maximum combustion efficiency at lowest possible cost, regardless of the quality of fuel used. This Stoker's unique ability to burn wet fuel as well as dry without clogging, assures adequate, dependable steam generation.

The hydraulically-driven grate requires little power, has a wide range of precision speed control, and is cheaper to operate and maintain. Its compact, fully-protected mechanism runs quietly and steadily and is adaptable to any type of combustion control.

Send for the Æ Perfect Spread Stoker Bulletin and look into all the advantages to be gained by modernizing your boiler room now—with the only Non-Clogging Stoker of its kind!

AMERICAN ENGINEERING COMPANY

2400 ARAMINGO AVENUE, PHILADELPHIA 25, PENNA.

FEEDS WET COAL

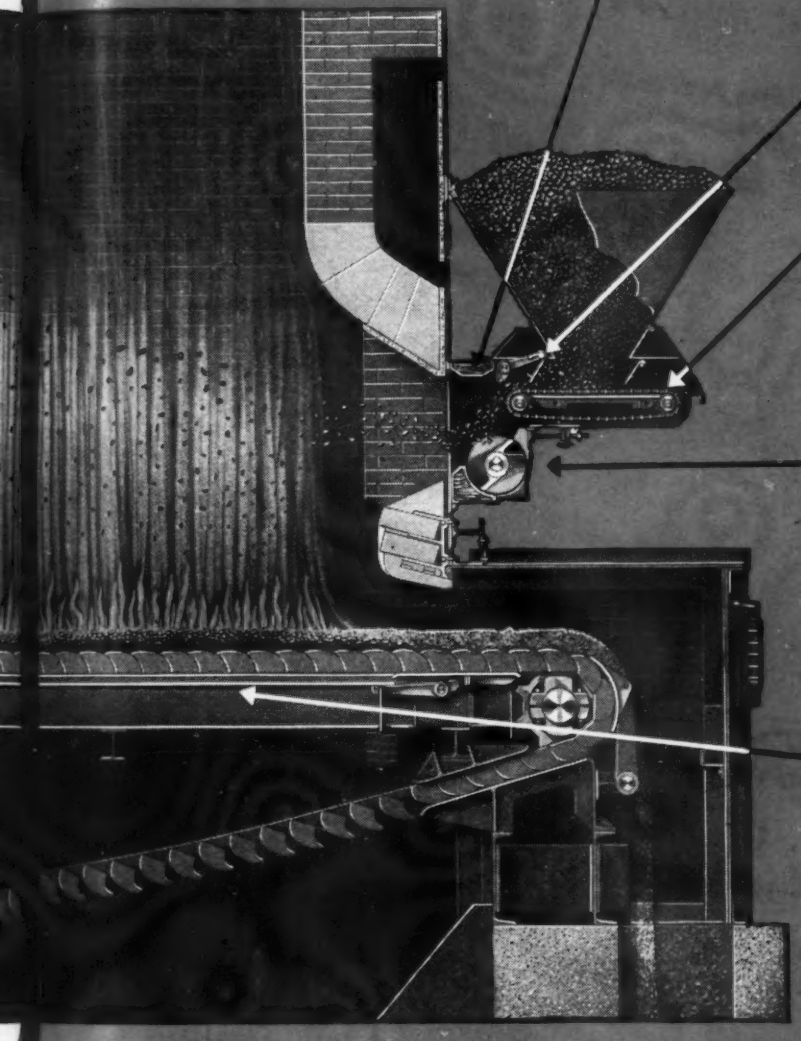
Chain Type Feeder carries coal from hopper to distributing rotor. Wide range of speeds automatically adjusted. 100% uniformity of feed. Protected from clogging—accessible from stoker front without tools. Amazingly quiet.

FEEDER UNIT WATER COOLED

Entire feeder unit protected against furnace temperatures by water cooling surrounding the furnace opening and rotor bearings.

EXCLUSIVE NON-CLOG SAFETY FEATURE

Prevents jamming and damage from foreign objects. Small material passes through to grate. Large objects stop feeder without harm. Unique shearing pin may be replaced easily . . . without tools!



EXCLUSIVE QUIET ADJUSTABLE FEEDER

An exclusive all-enclosed, oil-bathed, easily accessible mechanism drives the feeder. Feeds coal smoothly and quietly in an infinite number of steps from zero to maximum rate. Each feeder unit is regulated by automatic combustion control and can be shut off or disconnected independently of other sections.

EXCLUSIVE FUEL-DISTRIBUTING ROTOR

PERFECT SPREAD distribution over the entire grate area is produced by an exclusive design never before achieved in this type of stoker.

HIGH EFFICIENCY GRATE DESIGN

Traveling Grate provides completely automatic removal of ash, eliminating the dumping of grates and cleaning of fires, thereby maintaining top efficiency at all times. Handles high or low ash coals with equal ease. Extremely low power and maintenance costs.

Built with a background of 40 years combustion engineering and stoker design experience, the Perfect Spread Stoker has proved its advantages in scores of commercial and industrial installations. And with production going full speed to keep ahead of the orders pouring in, it is evident that the Perfect Spread Stoker is accepted as a highly efficient and economical stoker. In plants using steam for power, heating, or processing, the Æ Perfect Spread Stoker assures important savings. Be sure "to get the facts" that may favorably affect your whole future operation.

Write for our new bulletin today!

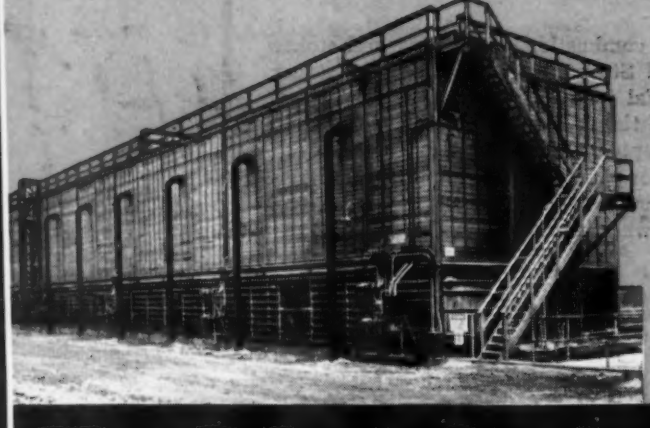
Other Æ Products: Æ-TAYLOR STOKERS, LO-HED HOISTS, MARINE DECK AUXILIARIES, HELE-SHAW FLUID POWER

REVERSE FLOW CONDENSER

Pioneered and Patented By Us

In our over fifty years of building surface condensers, we have occasionally found conditions that have required something in a condenser which had not even been thought of before. One of these problems was as follows: In a certain plant the only available condenser circulating water was full of leaves and other foreign matter, and mechanical screening was not found to be effective. To solve this problem, we invented a condenser having water boxes which reverse the flow of circulating water when desired, to remove the trash from the tube sheet with no drop in efficiency. Naturally, this "Reverse Flow" Condenser is the "Dual Bank" Design, which has been our standard for 30 years. Our new 44-page catalog describes our complete line of condensers. Write for it today.

C. H. WHEELER MANUFACTURING CO.
1800 SEDGLEY AVENUE, PHILADELPHIA 32, PA.
REPRESENTATIVES IN MOST PRINCIPAL CITIES



Water Cooling Towers of both induced and forced draft types, correctly engineered for any climatic conditions. Send for our 20-page catalog No. 145.

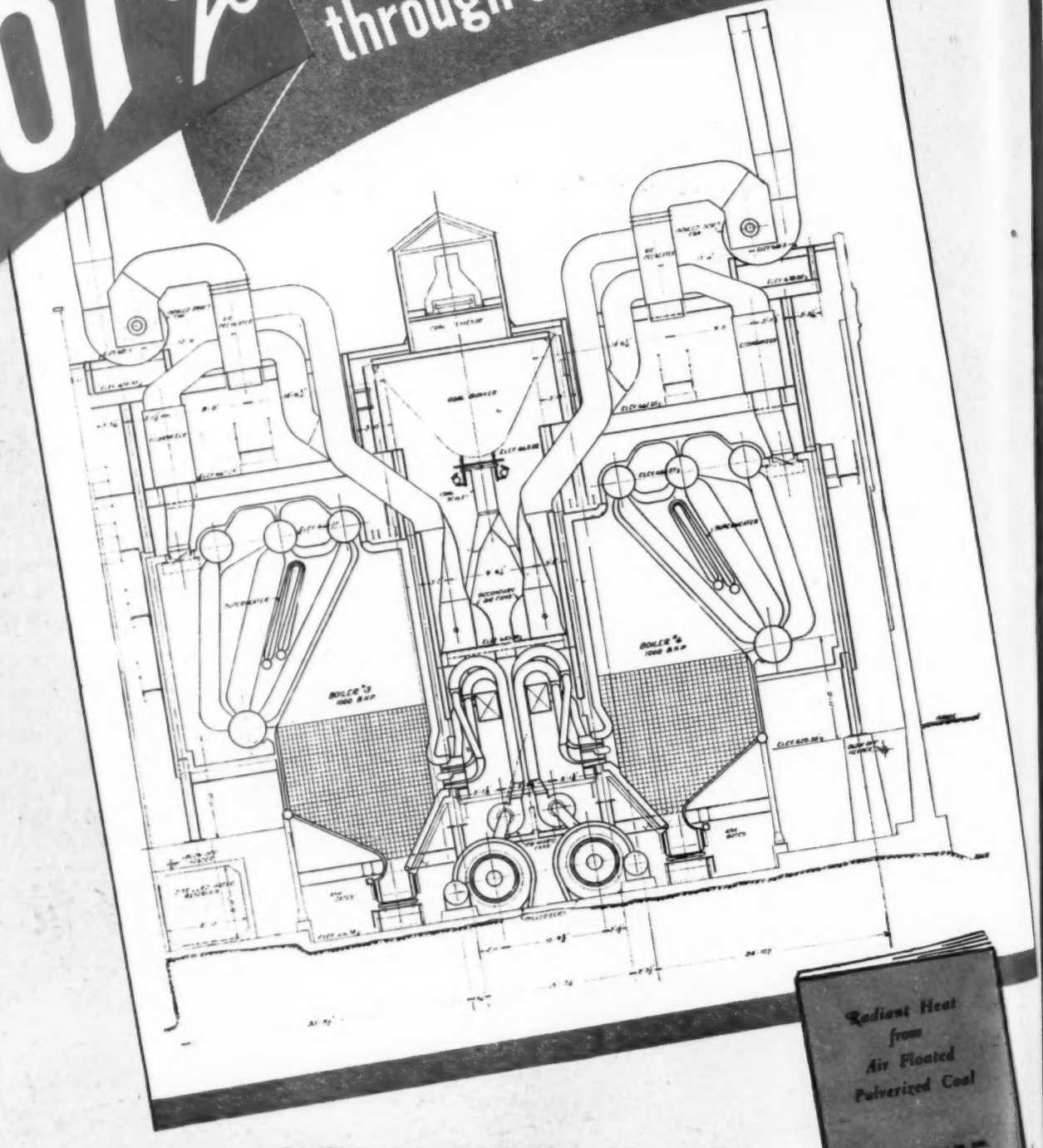
C. H. Wheeler

Tubejet Steam Jet Air Ejector with Combined Surface Type Inter-After Condenser. This type is designed especially for high temperature and high superheat; however, we build a complete line for every purpose.

Patented Reverse Flow, Dual Bank Steam Condenser. This design is described fully in our new catalog.

STEAM CONDENSERS • AIR EJECTORS
COOLING TOWERS • HEAT EXCHANGERS
OF PHILADELPHIA

87.5% MONTHLY OVERALL B
through SUPERFINE GRINDING W



Two KVS 5' x 9' Air swept Tube Mills per boiler at the Western United Gas & Electric Company, Aurora, Ill. *Send for Bulletin.*

BOILER EFFICIENCY with KVS AIR SWEPT TUBE MILLS LED TO REPEAT INSTALLATION

The following tests, after six months operation on Illinois coal, disclose the fine grinding attained with resultant high boiler efficiency, the average being approximately 93.3% through a 200 mesh screen.

It was on the basis of these tests, high availability, low maintenance costs and twenty years experience with this equipment that a repeat order for two 8' x 14' Integral Gear Air Swept Tube Mills, for the new 500,000 lbs. of steam per hr. boiler, was placed with KVS.

North Mill 9000 lbs. per hour	200 Mesh	100 Mesh	80 Mesh	50 Mesh
9:15 AM	91.8%	99.1%	99.7%	100%
9:45 AM	93.5	99.5	99.8	100
10:15 AM	93.8	99.6	99.8	100
Average	93.0%	99.4%	99.8%	100%

South Mill 9000 lbs. per hour	200 Mesh	100 Mesh	80 Mesh	50 Mesh
9:15 AM	92.2%	99.1%	99.7%	100%
9:45 AM	94.0	99.4	99.8	100
10:15 AM	93.8	99.6	99.8	100
Average	93.3%	99.4%	99.8%	100%

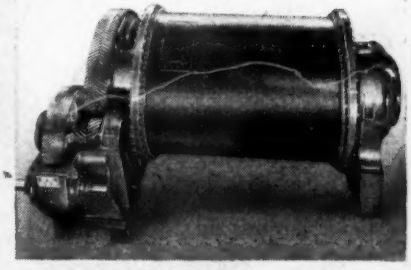
The three 1000 hp. boilers to which the above test applies are equipped with suuperheaters, economizers and air heaters. Furnaces are of water-cooled construction excepting front walls. Each boiler is fired with two KVS Air Swept Tube Mills, which afford better than 400% rating for each boiler.

Slagging is avoided by feeding the proper amount of balls to the pulverizer, while operating at capacity speed, to prevent pulverization dropping below 78% through 200 mesh screen. Power consumption is 14.1 KW per ton of coal pulverized: 53KW for entire boiler, mills, fans, regulators, feeders and induced draft fans. Maintenance cost on mills averaged $0.0122 per ton. Average overall monthly boiler efficiency was 87.5%, which means 90 to 92% at times.

To quote the Chief Engineer of this plant, "We believe we have the finest installation of pulverized coal in the country, high in efficiency and free from slagging trouble."

KVS ENGINEERING SERVICE

KVS Pulverizers and Steam Generating equipment have been performance-proved. KVS offers a complete engineering service in design, building and erecting complete boiler plants under one responsibility, outlined in Bulletin 44-B. KVS engineers are available for consultation on your requirements.



One of two KVS 8' x 14' Integral Gear Air Swept Tube Mills on Repeat Installation at this plant.

KENNEDY-VAN SAUN · QUALITY · SERVICE · Kennedy Products · NEW YORK · USA · MFG. & ENG. CORP.

Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

ARMY E NAVY

2 PARK AVENUE • NEW YORK 16, N. Y.

FACTORIES: DANVILLE, PA.

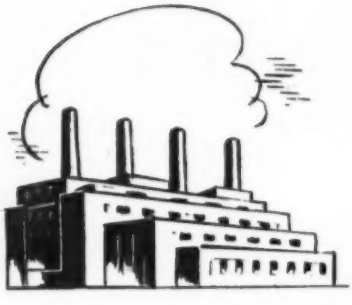
CANADA • ENGLAND • FRANCE • AUSTRALIA

maintains FINENESS independent of wear

The degree of fineness of pulverized coal fired in a steam generator has a direct effect on overall boiler efficiency. Tests made by a public utility showed a gain of more than 4% in overall boiler plant efficiency when fineness was increased from 45% to 70%.* Any pulverizer which delivers high initial fineness but is unable to maintain it will be directly responsible for an efficiency drop. Therefore, it is essential that fineness be maintained at the level of new mill performance.

Continuous high fineness is maintained in FW pulverized fuel systems by periodic additions to the ball charge *while the mill is in operation.* The ball charge is the pulverizing agent, and the only wear which affects fineness is attrition of these steel balls. Since they can be renewed whenever necessary, fineness is controlled at all times *independent of wear.*

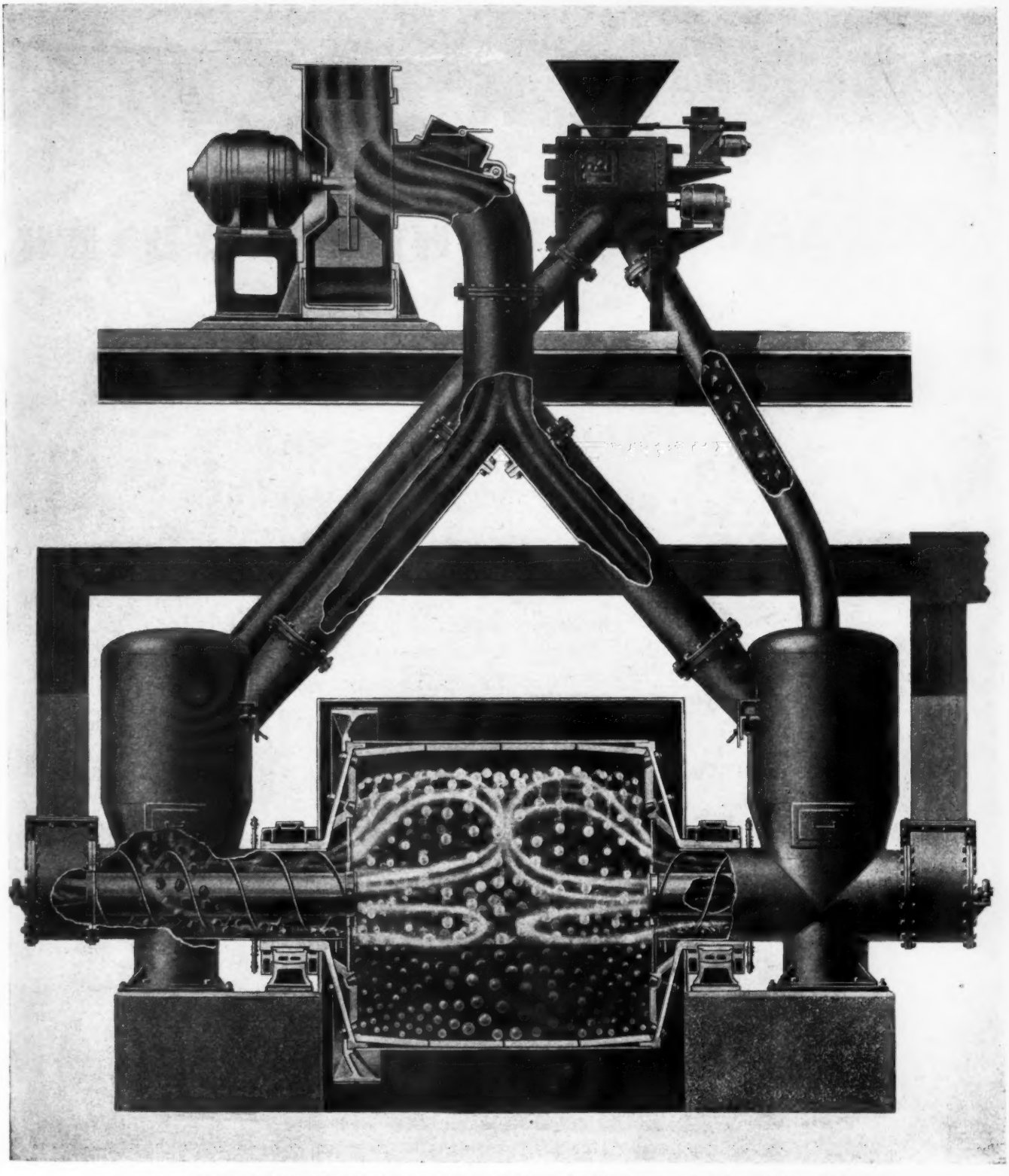
**ASME Transactions FSP, 54-7 Page 55*



BALL MILL PULVERIZERS GIVE YOU

CONTINUOUS HIGH FINENESS
HIGH AVAILABILITY (AVERAGES 99%)
LOW MAINTENANCE

FOSTER WHEELER CORPORATION • 165 BROADWAY, NEW YORK 6, N. Y.



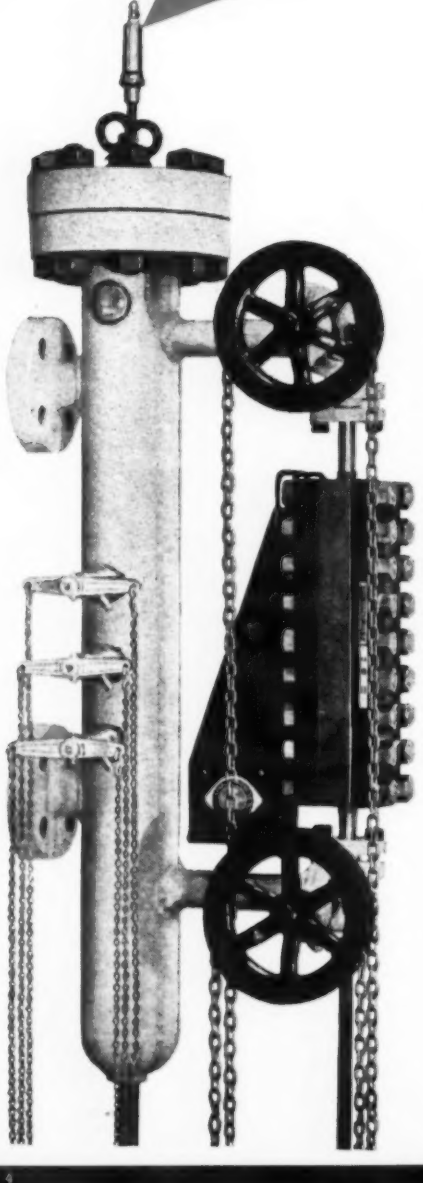
Important details of ball mill pulverizer operation are shown in this phantom drawing. As the conical mill revolves, heavy steel balls pulverize the fuel particles to the desired fineness. Air drawn through the mill by an exhauster picks up the powdered fuel and carries it in suspension through the classifiers, where any heavy particles drop out. These are returned to the mill, leaving only finely powdered fuel to be carried on to the burners. As the steel balls wear, a new charge is added while the mill is in operation.

FOSTER WHEELER

One

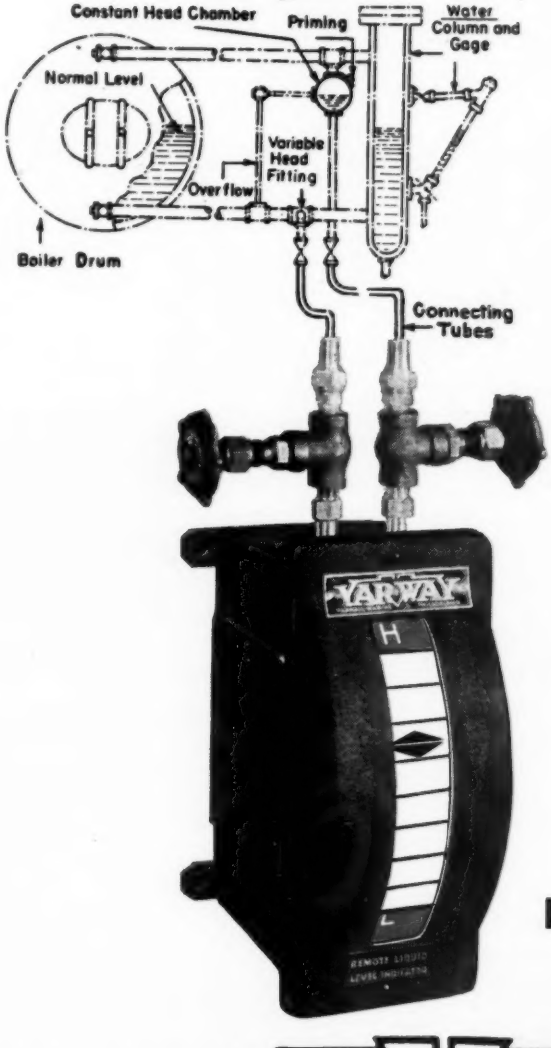
WHEN YOU BUY

YARWAY WATER COLUMNS AND GAGES



A

YARWAY REMOTE BOILER WATER LEVEL INDICATORS



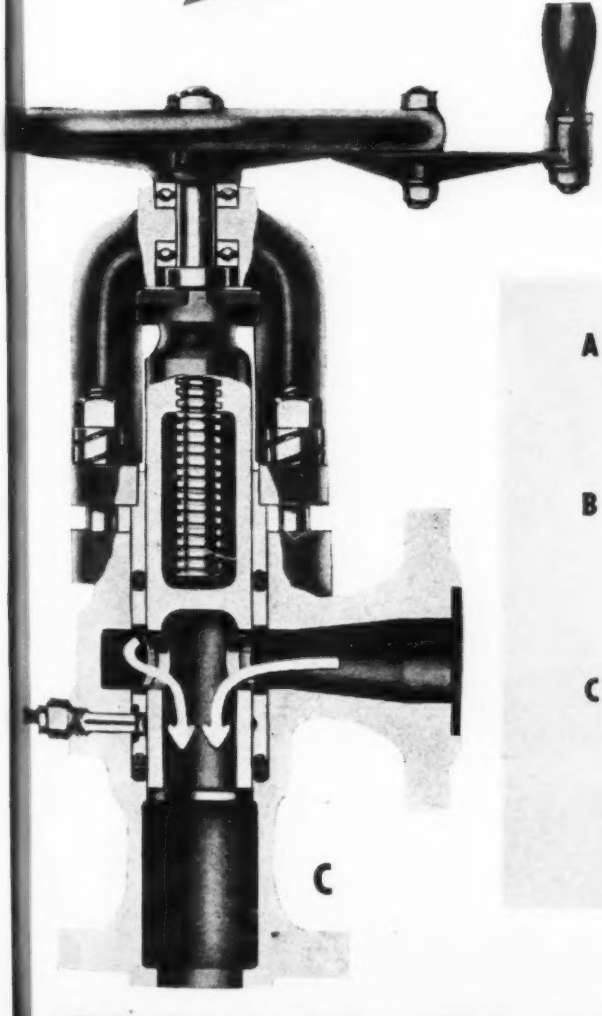
B

YARWAY

RESPONSIBILITY

all 3 FROM YARWAY

YARWAY BLOW-OFF VALVES



Power plant engineers may simplify responsibility by insisting that all three of these important boiler trim items be Yarway.

Why, you ask?

First, responsibility for the satisfactory performance of all three is centered in one company.

Second, Yarway's extensive service organization, with branches in principal cities in the United States and Canada, is conveniently at your service.

Third, each product has an outstanding feature—an *engineering reason,* laboratory-tested and field-proved for better performance.

For more complete facts on these and other products in the Yarway line of steam plant equipment, write for Yarway's all-products Catalog G-1306.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.

A — Yarway Hi-Lo Alarm *Floatless* Water Column with patented Yarway Flat Glass Gage featuring a "floating assembly" that practically eliminates glass breakage. For pressures from 400 to 2500 psi. Other Yarway Columns and Gages for lower pressures. Write for Yarway Bulletin WG-1810.

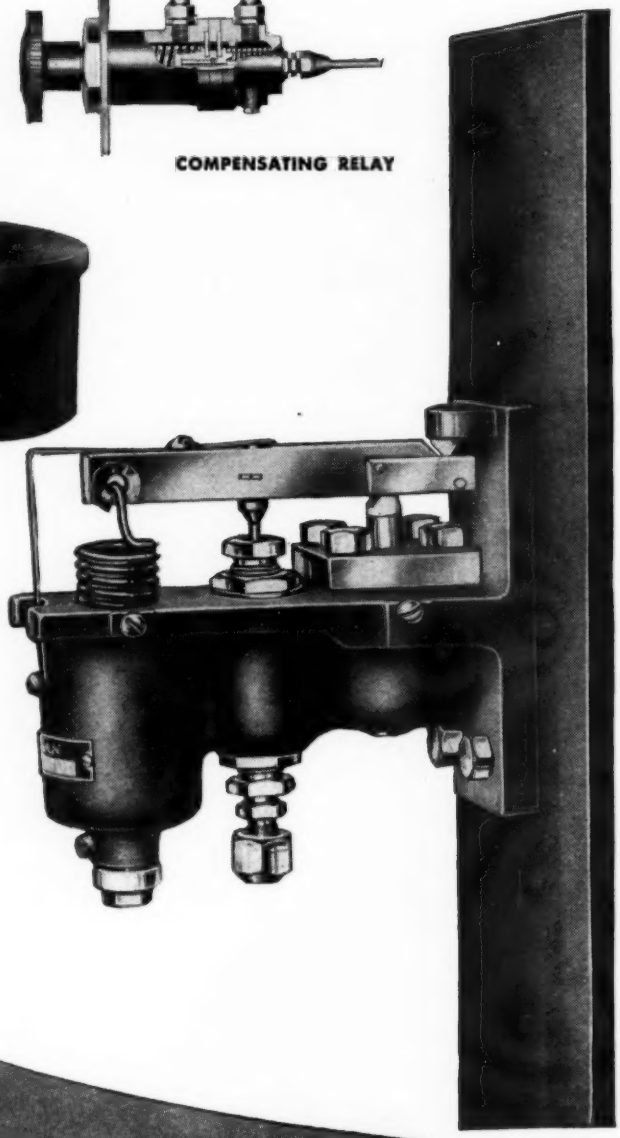
B — Yarway Remote Boiler Water Level Indicator that brings overhead readings right down to eye level, on instrument panel or other convenient place. Always accurate because it's operated by the boiler water itself. Action is instant, constant. *No stuffing boxes.* Moderate in price. Easy to install. For all pressures to 1500 psi. Write for Yarway Bulletin WG-1821.

C — Yarway Seatless Blow-Off Valve. No seat to score, wear and clog with mud, scale and dirt. Balanced sliding nitralloy plunger simplifies operation. Also furnished in Tandem, or as a Unit Tandem combined with a Yarway Hard-Seat Valve for highest pressures. Write for Yarway Bulletin B-424 for pressures to 400 psi; Bulletin B-432 for pressures to 2500 psi.

STEAM PLANT EQUIPMENT

COMPENSATING RELAY

BALANCED FLOAT REGULATOR

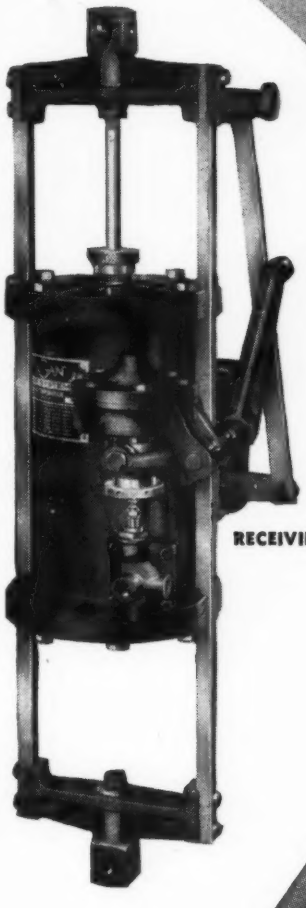


TYPE "FL" MASTER SENDER

HAGAN
HALL
BUROMIN
CALGON

Fuel Economy

FOR SMALLER PLANTS



RECEIVING REGULATOR

Fuel economy has made automatic combustion control standard equipment in virtually every large power plant.

Fuel economy through automatic combustion control is just as important in small plants. Control systems in these plants need not be as elaborate as in larger plants, but they must meet large-plant standards of quality and performance, and their cost must not be out of proportion to the savings they produce.

The Hagan simplified automatic control system meets the needs of these plants. For some plants this may consist essentially of only the Hagan Master Regulator and one or more Hagan Balanced Float Regulators. Others may require the Hagan Unit Control System, with the Hagan Master Sender supplying a loading for relays and power units regulating air and fuel input, and with the Hagan Type D Regulator and Receiving Regulator maintaining constant furnace draft.

In either case, the result is a rugged, efficient system that *pays for itself* in lower fuel costs.

Our engineers will be glad to show you how a *simplified* Hagan system will meet the needs of your plant. Write for full information.

All Hagan control systems are designed on the principle that *control* and *metering* are separate functions. Only when these functions are kept separate can control equipment have the dependability, ruggedness, sensitivity, and speed of response that are essential for the proper operation of Automatic Combustion Control systems.

HAGAN CORPORATION, HAGAN BUILDING, PITTSBURGH 30, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

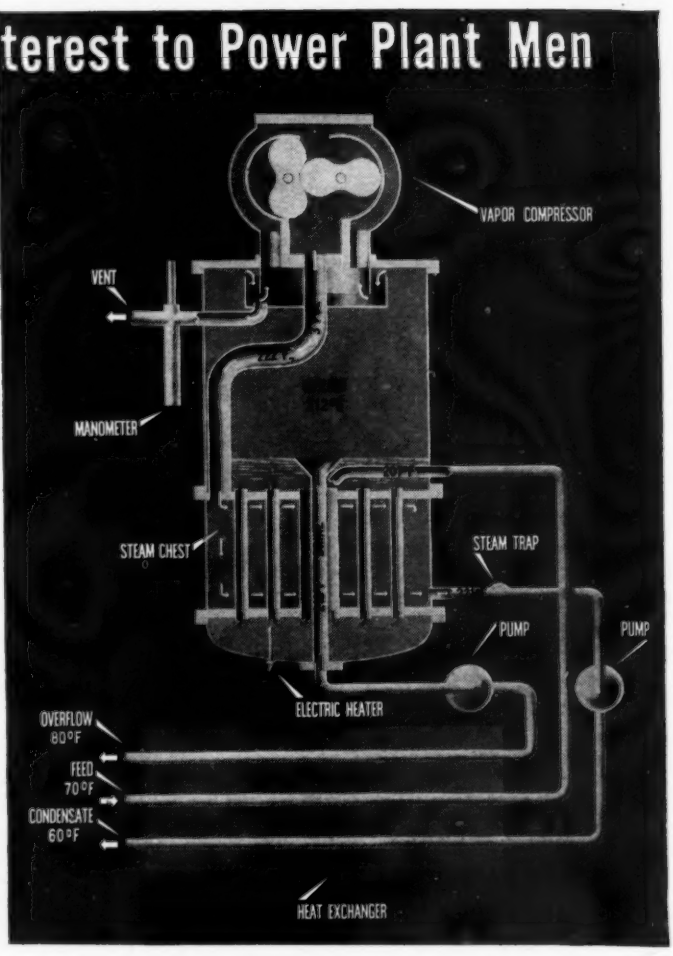
A Wartime Development of Interest to Power Plant Men

The **BADGER-KLEINSCHMIDT**

VAPOR COMPRESSION

WATER STILL

POSSIBLE INDUSTRIAL APPLICATIONS INCLUDE USE TO PURIFY HIGH PRESSURE BOILER FEED WATER



American commanders of troops assaulting the Pacific Islands never had to worry about water for their men.

Always at hand was an unlimited reservoir . . . *the sea.*

The link between the salty Pacific and pure drinking water was a distillation unit so efficient that a gallon of fresh water was obtained from the same heat input needed to bring a quart of water to the boil on a kitchen stove.

The unit was . . . ***the Badger-Kleinschmidt Vapor Compression Water Still,*** developed by Dr. R. V. Kleinschmidt of Arthur D. Little, Inc. and manufactured by E. B. Badger & Sons Co., Boston, Mass.

A major problem in designing the unit was the selection of materials. Combat use permitted a minimum of maintenance.

To counter the abrasive and corrosive conditions, nickel alloys were used throughout. For example, all sheet metal parts were made of a copper-nickel alloy. All nuts, bolts, studs, tie-rods, valves, piping and other fittings were Monel.*

With nickel alloys on the job it was no wonder that reports came back from the Pacific telling of Badger-Kleinschmidt stills operating smoothly even after their steel framework and housing had almost been completely eaten away.

That's why E. B. Badger & Sons Co. plans to continue using Monel in industrial vapor compression stills.

You build-in EXTRA performance when you use nickel alloys for equipment to handle steam or water.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

OPERATING PRINCIPLE

THE VAPOR COMPRESSION STILL'S conservation of heat is a close approach to perpetual motion. Feed water intake is through a heat exchanger. Sandwiched between concentric pipes carrying hot condensate and brine overflow, the feed water is raised to 207° F. Passing to the steam chest, it circulates through tubes surrounded by compressed steam at 222° F. This boils the water. The generated steam then goes to the compressor where it in turn is boosted to 222° F. Passing into the steam chest, it gives up most of its latent heat and boils new feed water. Then it passes through the heat exchanger and emerges as potable distillate.

In diesel-powered units, the exhaust supplies all the heat. In electric units, a separate electric heater is used. Thermal efficiency is 15 times that of ordinary single-phase stills.

TWO PUMPS are used on every B-K still. Many units are equipped with Warren SED vertical pumps. The SED, manufactured by WARREN STEAM PUMP Co., Warren, Mass., has a 1¼" Monel shaft and a "K" Monel shaft sleeve.

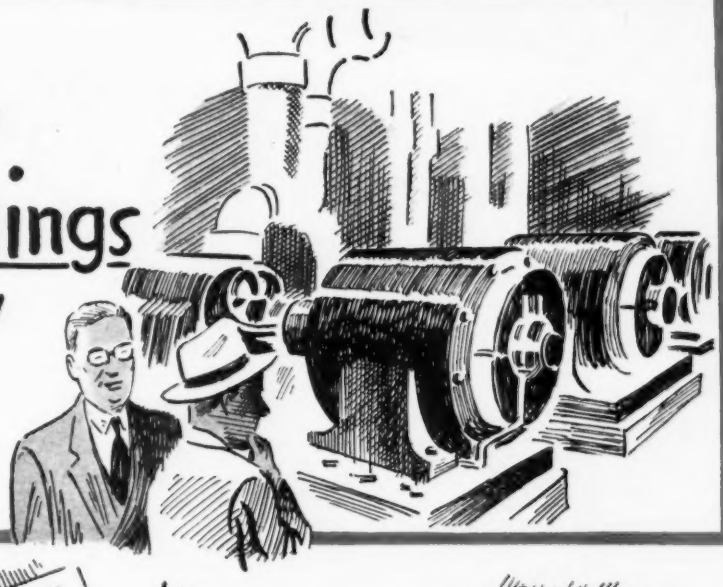
A PORTABLE B-K STILL used by the Army, Marines and Seabees. Fixed installations were aboard submarines and other Navy craft. E. B. BADGER & SONS Co. is ready to make stills up to capacities of 100,000 gallons per day. With these large-scale models available to economically distill high-pressure boiler feed water, boiler corrosion may well be licked.

NICKEL (INCO TRADE MARK) **ALLOYS** MONEL* • "K"* MONEL • "KR"* MONEL • "R"* MONEL • "S"* MONEL • INCONEL* • NICKEL • "L"* NICKEL • "Z"* NICKEL

*Reg. U.S. Pat. Off.

"For This Job, Give Me Two Things in a Motor"

. . . said the Power Plant Engineer



"To Drive Boiler Feed Pumps, motors must first be *simple*. For example, take these three Allis-Chalmers 800 hp, 3600 rpm motors. They're 2-pole, squirrel-cage, single winding machines . . . with practically fool-proof rotors and sleeve bearings. But second, and even *more* important . . .

They've Got to be Dependable! Here's what I mean. These same motors have given us 17 years of uninterrupted service. We've had to order replacement parts for them only twice . . . at a total cost of less than $12 a year. We call that *good performance* . . . the kind we've come to expect of *all* your motors!"

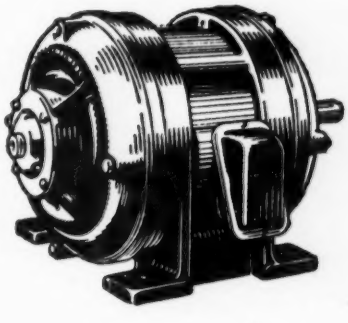
Frankly, Mr. Reader, we *are* mighty proud of our 2-pole motors. We've been developing them for high-speed requirements like this from the very earliest. Licked a lot of problems too. Like cutting down noise through better design . . . reducing windage noise with proper baffling, and curbing magnetic noise. . .

We're Getting Better Efficiencies and power factor . . . and lower starting kva, through improved squirrel-cage design. We've designed bearing brackets generously for greater structural rigidity. In fact, all the way around you can expect to find long life and low maintenance built-into our motors!

Yes, "A-C" Means Long Life in Motors!

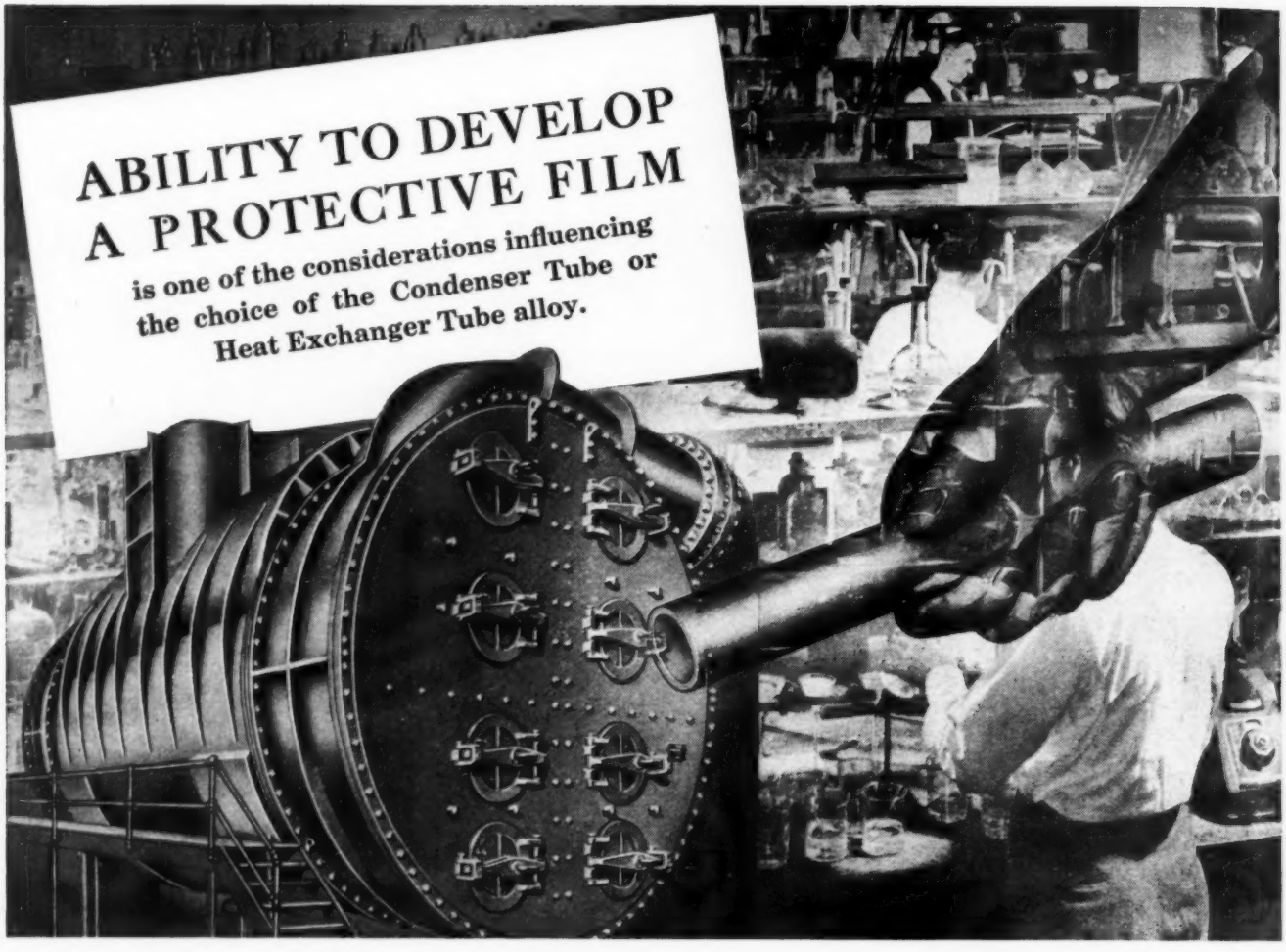
REGARDLESS of size or type you'll be money ahead with Allis-Chalmers motors. For at A-C you can expect and *get* the same careful engineering, generous design and long-life operation that thousands of motor buyers have come to rely upon through the years.

And remember . . . while many jobs call for special or modified motors, there are *many more* that can be solved with *standard* motors . . . at less cost . . . and often with saving in time! ALLIS-CHALMERS, MILWAUKEE. A 2082



ALLIS CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products


ABILITY TO DEVELOP
A PROTECTIVE FILM
is one of the considerations influencing
the choice of the Condenser Tube or
Heat Exchanger Tube alloy.

It is a generally accepted concept that the corrosion resistance of any condenser tube is a function, among other things, of the nature of the corrosion product formed during the early service life of the tube. The maximum corrosion resistance is attained when this product is an adherent film which is insoluble, continuous, microscopically thin, stable and impervious. The extent to which the film approaches these properties determines its relative ability to resist subsequent attack.

In actual operating conditions, the ability of any particular alloy to form a protective film is influenced by the nature and/or extent of such factors as:

Chemical composition of media in contact with tubes . . . Dissolved or entrained air or gases . . . Velocity and turbulence of coolant . . . Temperatures inside and outside of tubes . . . Marine growths or other deposits . . . Sewage and wastes present . . . Chemical or Electro-Chemical actions.

The development of alloys designed to render longest life and most trouble-free service under severe operating conditions has been one of the principal objectives of Condenser Tube Technical Research. Phosphorized Admiralty, Aluminum Brass, Cupro-Nickel, Red Brass, Arsenical Copper and Muntz Metal are each capable of developing a protective film in the conditions most suited for its use. Where unusual conditions are met, it is sometimes necessary to use a special alloy not generally recognized as a condenser tube alloy.

So many variables surround any condenser or heat exchanger tube application that each case must be treated as an individual problem.

Data accumulated during Scovill's continuous study of condenser and heat exchanger tube service conditions for every known application equip its Technical Service Department to offer sound guidance in tube alloy selection for existing or proposed installations.

THREE SCOVILL SERVICES

Scovill's *Service in Men* offers experienced engineering to help solve your tube selection and installation problems. *Service in Metals* develops and produces Scovill tube alloys that conform to your requirements. *Service in Manuals* consists of literature which gives you latest, authentic information on condenser and heat exchanger tubes. For a free copy of Condenser Tube Booklet, address Scovill Manufacturing Co., 13 Mill St., Waterbury 91, Conn. *Export Department:* 405 Lexington Ave., New York 17, N. Y.

SCOVILL

SCOVILL

CONDENSER TUBES

One Product • Three Services

Service in Manuals . Service in Metals . Service in Men

NO. 5

Helpful Hints on Applying Capacitors

A Summary of the Applications of Capacitors in Industrial Plants

DO YOU HAVE A POWER FACTOR* PROBLEM?

If you are being penalized by a power factor or kva demand clause in your power contract, capacitors can save you money. By supplying your magnetizing current (kilovar) requirement at your plant by means of capacitors, the savings are always significant, frequently startling. It is not unusual for these savings to total more than the monthly demand charge. Your General Electric representative will gladly show you how these savings run.

THE USE OF CAPACITORS FOR RELIEVING OVERLOADED CIRCUITS

Very often, the judicious use of capacitors can solve an overloaded circuit problem in your plant. Capacitors reduce line load by supplying kilovars on the spot where magnetizing current is needed. Capacity increases up to 50 per cent have been reported following installation of capacitors; increases of 30 per cent and more are far from unusual.

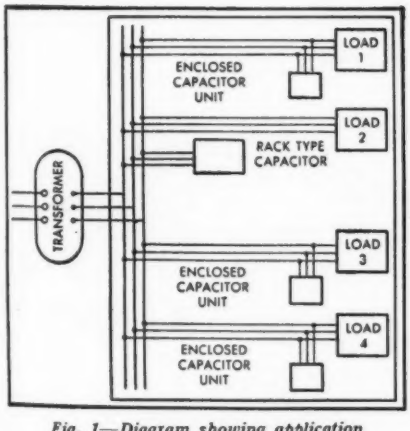


Fig. 1—Diagram showing application of capacitors in industrial plant.

THE USE OF CAPACITORS FOR REDUCING THE COST OF OPERATING RESISTANCE WELDERS

By inserting the proper capacitors in series in resistance welding lines, power factor improvement can be achieved which reduces the demand load by compensating for the welder reactance. This generally allows the feeder to handle either additional regular loads, or larger resistance welding loads, often without any replacement of wiring.

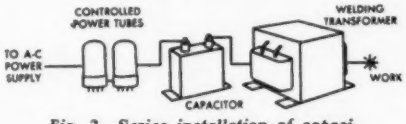


Fig. 2—Series installation of capacitors in welding circuit.

THE USE OF INDIVIDUAL CAPACITORS FOR MORE EFFICIENT MOTOR OPERATION

Low voltage, often due to overloaded circuits, causes excessive heating in motors, resulting, eventually, in breakdowns and burnouts. One remedy for this is the individual motor capacitor, consisting of one or more standard capacitor units, which may be mounted either directly on the motor frame, or near the motor. They are easily connected—either across the motor terminals, or across the terminals on the load side of the motor starter, but ahead of the overload protective device. Flexibility of installation makes these units ideal for power factor improvement in practically any type of plant.

Fig. 3—This motor shows a reading of 10 amperes at 80 per cent power factor. Therefore only 8 amperes are being used for horsepower. The remainder represents reactive current, necessary to magnetize the motor.

Fig. 3 (b)—After capacitor is added to supply the kilovars, the line delivers only 8 amperes for exactly the same horsepower output.

CAPACITOR INSTALLATION RESULTS IN IMPROVED LIGHTING

Improved lighting is one of the main by-products of improved power factor. Properly applied, capacitors eliminate poor voltage conditions resulting from low power factor loads of motors, welders, transformers and other power equipment. This in turn does away with low light level and you get all the light you are paying for.

G-E application engineers will be glad to work with you in deciding whether capacitors can help your operation. Just call your G-E representative. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

★ ★ ★

* A large portion of modern industrial loads is made up of motors and other equipment which require magnetizing current, or kilovars, for their operation. These kilovars, together with the kilowatts required for useful horsepower output, make up the total demand from the power company's system. The term "power-factor" is used to designate the ratio of power current to the total current; thus the smaller the number of kilovars required, the higher the power-factor, approaching unity (100%) as a limit when kilovars equal zero. Average power factor can be expressed as the ratio of kilowatt hours to the total kva hours.

GENERAL ELECTRIC

PYRANOL CAPACITORS

Making GARLOCK 7021 Compressed Asbestos Sheet Packing at the Garlock factory.

Just the Right Mixture

In the manufacture of Garlock 7021 High Pressure Sheet Packing, long fibre asbestos is mixed with rubber binder according to a Garlock formula and to exacting Garlock standards. The mix is fed into sheeters and is compressed under heat into this superior gasketing material.

Expert workmanship and quality control result in a compressed asbestos sheet of great strength and uniformity. For satisfactory service use Garlock 7021 on pipe lines and other equipment handling gasoline, oil, gas or steam at high temperatures and extreme pressures.

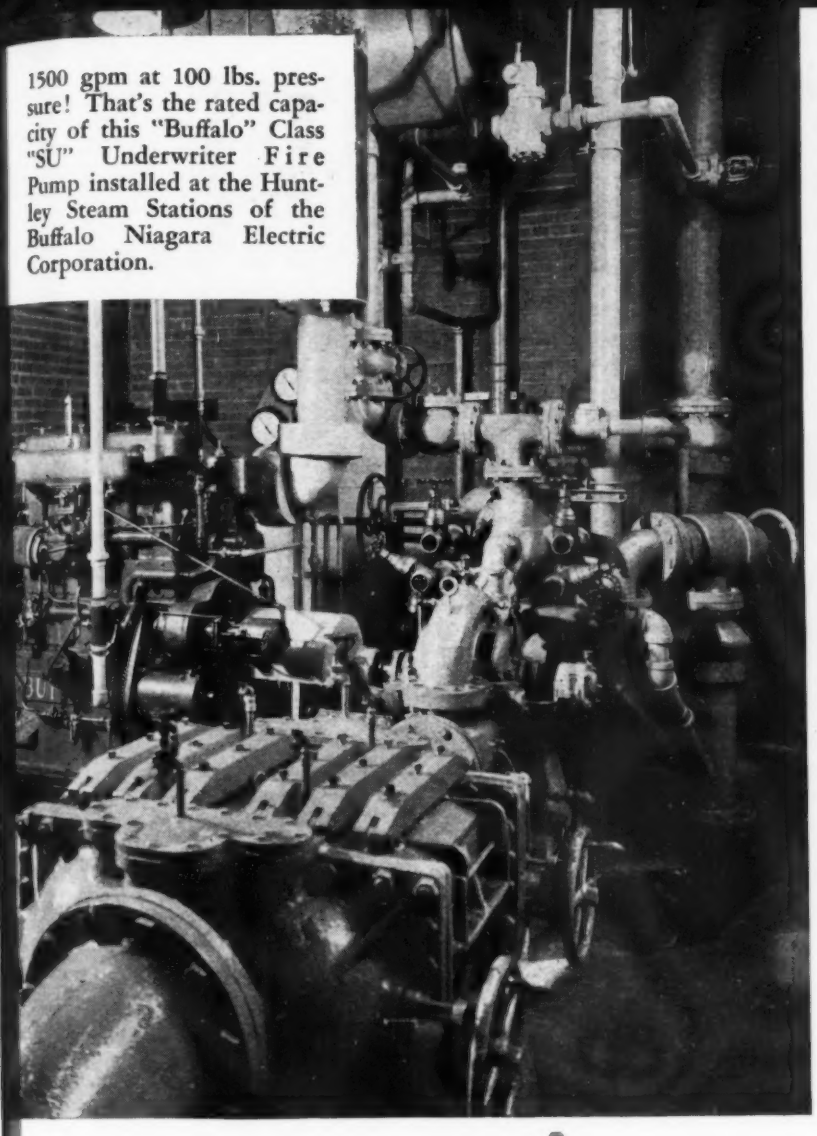
THE GARLOCK PACKING CO.
PALMYRA, N.Y.

In Canada: The Garlock Packing Co. of Canada Ltd., Montreal, Que.

60th Anniversary 1887 – 1947

Thicknesses from 1/64" to 1/4". Sheets 40"x40" and larger.

GARLOCK 7021 COMPRESSED ASBESTOS SHEET PACKING



1500 gpm at 100 lbs. pressure! That's the rated capacity of this "Buffalo" Class "SU" Underwriter Fire Pump installed at the Huntley Steam Stations of the Buffalo Niagara Electric Corporation.

ARE YOUR FIRE PUMPS

Ready to Deliver?

With "Buffalo"

YOU CAN BE SURE!

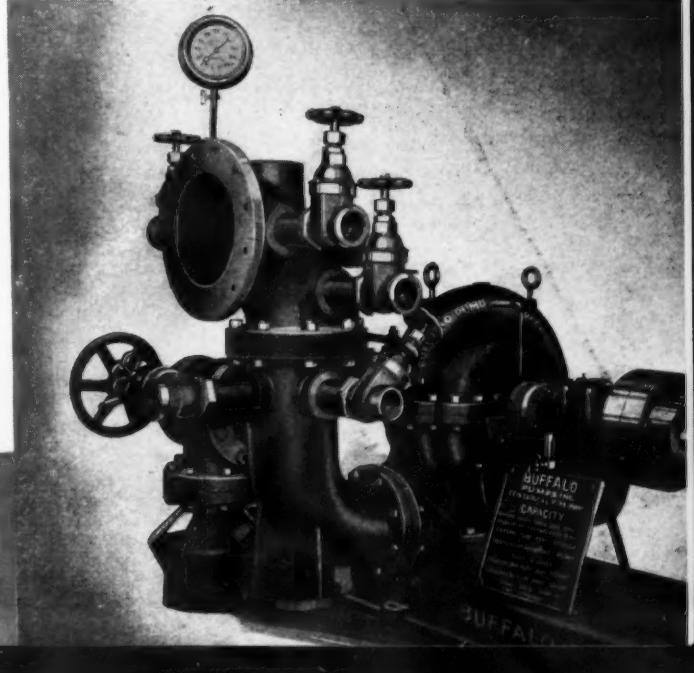
● A fire pump installation may sit idle for long periods . . . but when emergency strikes, it MUST DELIVER!

When you specify a "Buffalo" Underwriter Fire Pump, you have this kind of DEPENDABILITY . . . backed up by over sixty years of pump building. Why not write us for your copy of Bulletin 955 and note the construction and performance specifications. You'll see why these husky, high-efficiency "Buffalo" pumps can be COUNTED ON when you need their service!

BUFFALO PUMPS, INC.

488 Broadway **Buffalo, N. Y.**

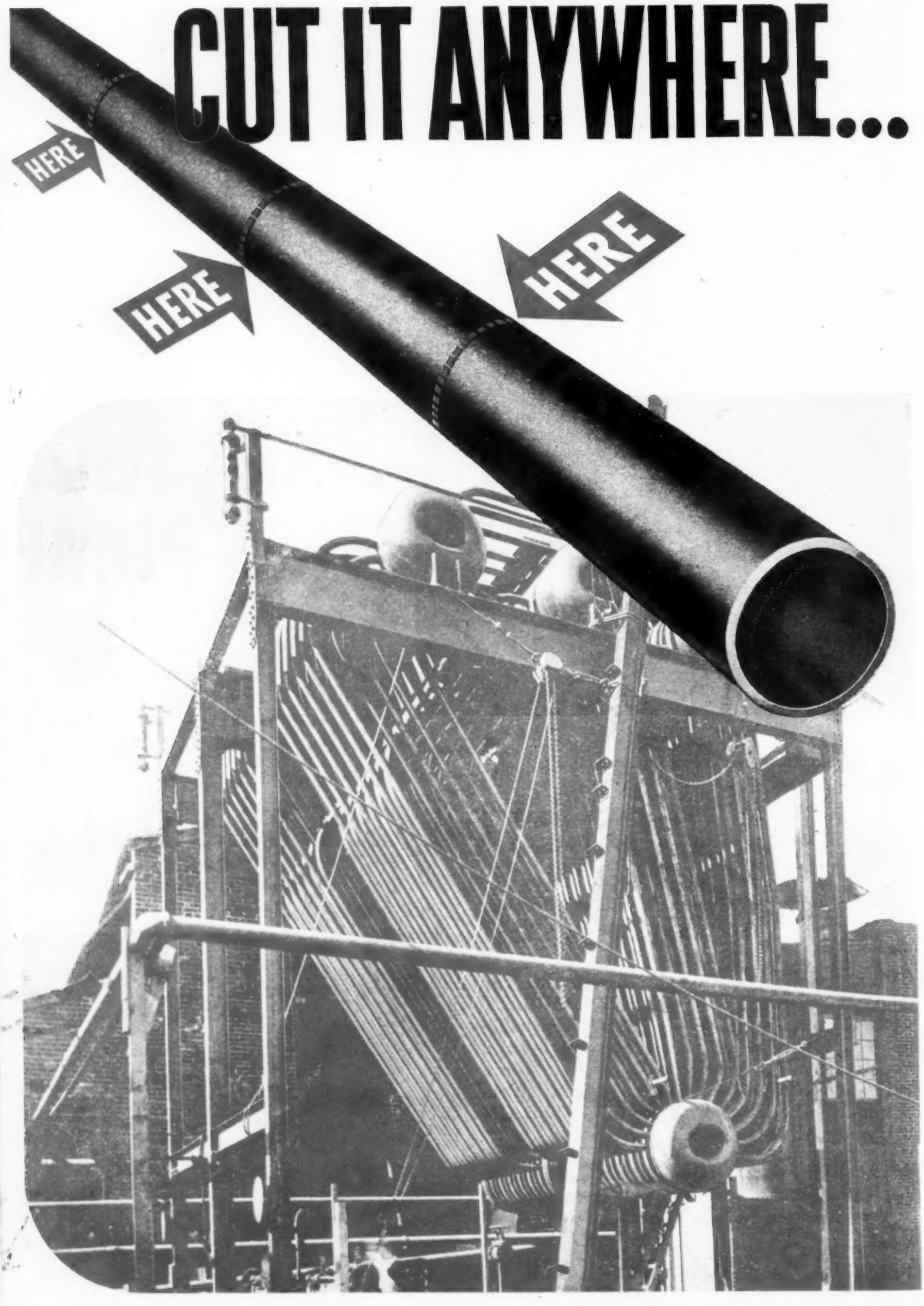
Canada Pumps, Ltd., Kitchener, Ont.



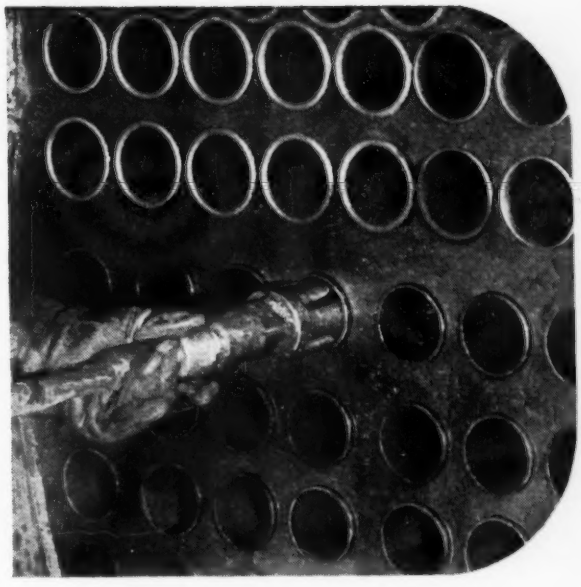
"Buffalo"

UNDERWRITER FIRE PUMPS

CUT IT ANYWHERE...



ELECTRUNITE BOILER TUBES



Always Roll in Easily

It's a fact—you can cut an ELECTRUNITE Boiler Tube at any point, and the cut ends will roll in just as easily as the original ends. Yet Republic's practice of full normalizing the *entire length* of *every* tube is just one of the features which save time and money for ELECTRUNITE users.

These *modern* tubes are consistently UNIFORM in diameter, wall thickness and concentricity—due to Republic's improved electric resistance welding process.

They slide through tube sheet holes freely, roller expand and bead over to smooth, non-leaking joints easily and quickly. Rare, indeed, is the occasion when "weepers" are found in pressure testing a completed ELECTRUNITE installation.

Every ELECTRUNITE tube must pass a rigid testing routine, both during and after fabrication—including hydrostatic testing at pressures in excess of code requirements—offering you positive assurance that each tube is uniformly sound and strong throughout.

There's no need to worry about valve-clogging scale or corrosion-inviting scale pits, either. ELECTRUNITE Boiler Tubes are made from highest quality, flat-rolled steel, carefully inspected on both sides before processing.

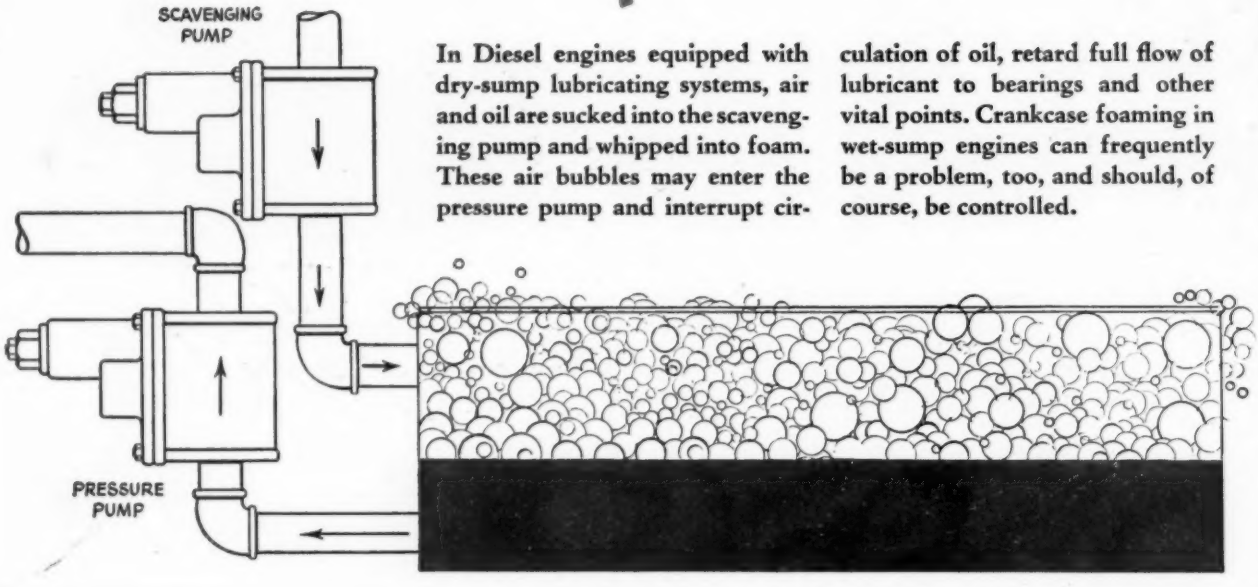
Proof of ELECTRUNITE acceptance is found in the fact that more than 150,000,000 feet have been installed in all types of stationary, railroad and marine boilers, and in other steam generating and heat transfer equipment throughout industry. Write for the new brochure on boiler, heat exchanger and condenser tubes.

REPUBLIC STEEL CORPORATION
STEEL AND TUBE DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic
ELECTRUNITE
Reg. U. S. Pat. Off.
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

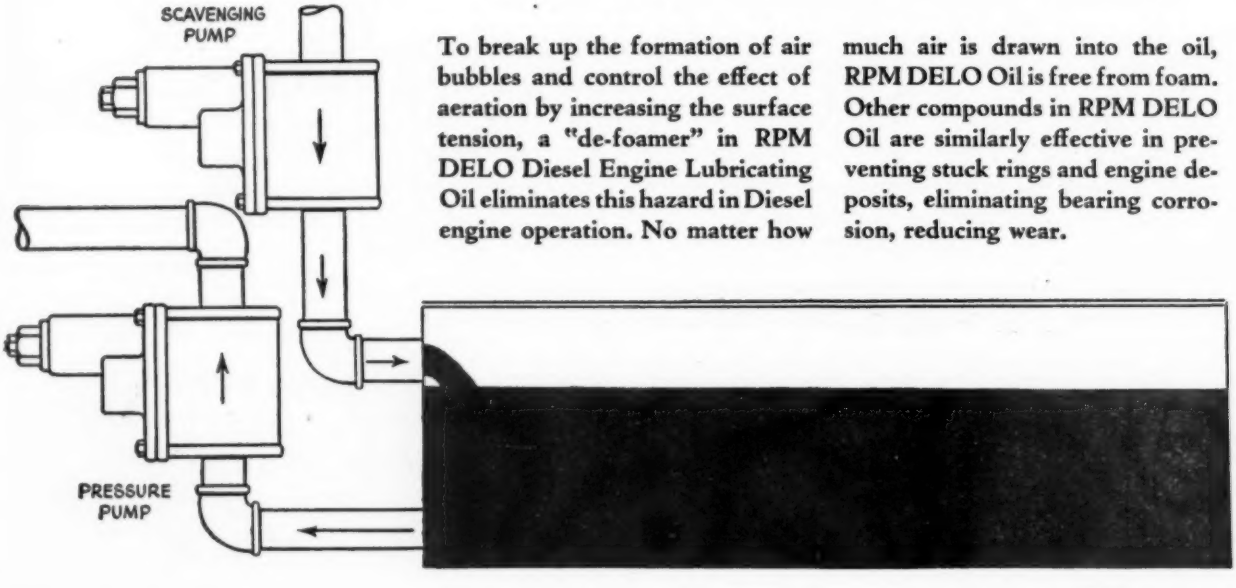
Diesel Engine DANGER points

AIR BUBBLES ENDANGER OIL CIRCULATION



In Diesel engines equipped with dry-sump lubricating systems, air and oil are sucked into the scavenging pump and whipped into foam. These air bubbles may enter the pressure pump and interrupt circulation of oil, retard full flow of lubricant to bearings and other vital points. Crankcase foaming in wet-sump engines can frequently be a problem, too, and should, of course, be controlled.

RPM DELO OIL PREVENTS CRANKCASE FOAMING



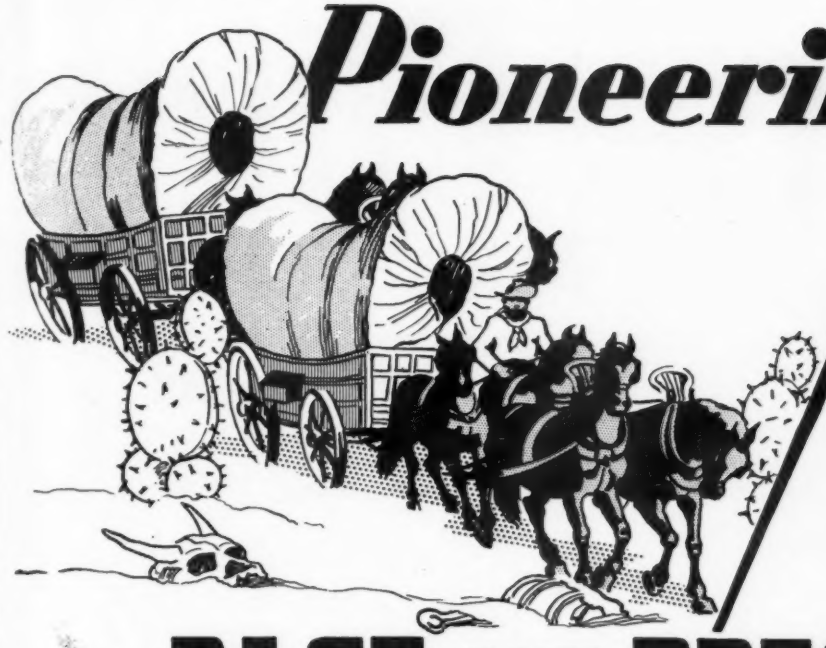
To break up the formation of air bubbles and control the effect of aeration by increasing the surface tension, a "de-foamer" in RPM DELO Diesel Engine Lubricating Oil eliminates this hazard in Diesel engine operation. No matter how much air is drawn into the oil, RPM DELO Oil is free from foam. Other compounds in RPM DELO Oil are similarly effective in preventing stuck rings and engine deposits, eliminating bearing corrosion, reducing wear.

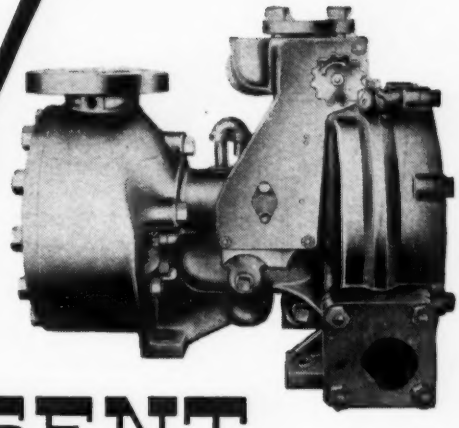
To match the fine performance of RPM DELO OIL, use these equally efficient companion products from the same famous "RPM" line—RPM HEAVY DUTY MOTOR OIL—RPM COMPOUNDED MOTOR OIL—RPM GEAR OILS AND LUBRICANTS—RPM GREASES. For additional information or name of your distributor, write any of the companies below:

STANDARD OF CALIFORNIA • 225 Bush St., San Francisco 20, California
THE CALIFORNIA COMPANY • 17th and Stout Streets, Denver 1, Colorado
STANDARD OIL COMPANY OF TEXAS • El Paso, Texas
THE CALIFORNIA OIL COMPANY • 30 Rockefeller Plaza, New York 20

DIESEL ENGINE RPM DELO LUBRICATING OIL

Pioneering





PAST AND PRESENT

THE same courage that refused to accept conventional boundaries in the past pioneered the Coffin Turbo pump.

Over twenty years ago the Coffin Pump crossed conventional speed boundaries and aimed at a definite goal of compactness, light weight and economy.

Through patented engineering design and high speed operation it performs in a single stage, work that formerly required pumps many times its size and weight.

The thousands of installations made to date have proven that there are no boundaries for engineering skill plus the pioneering spirit.

Today the Coffin Turbo Pump is the talk of the Industry.

THE J. S. COFFIN, JR., COMPANY

326 SOUTH DEAN STREET
ENGLEWOOD, NEW JERSEY

Mail the Coupon

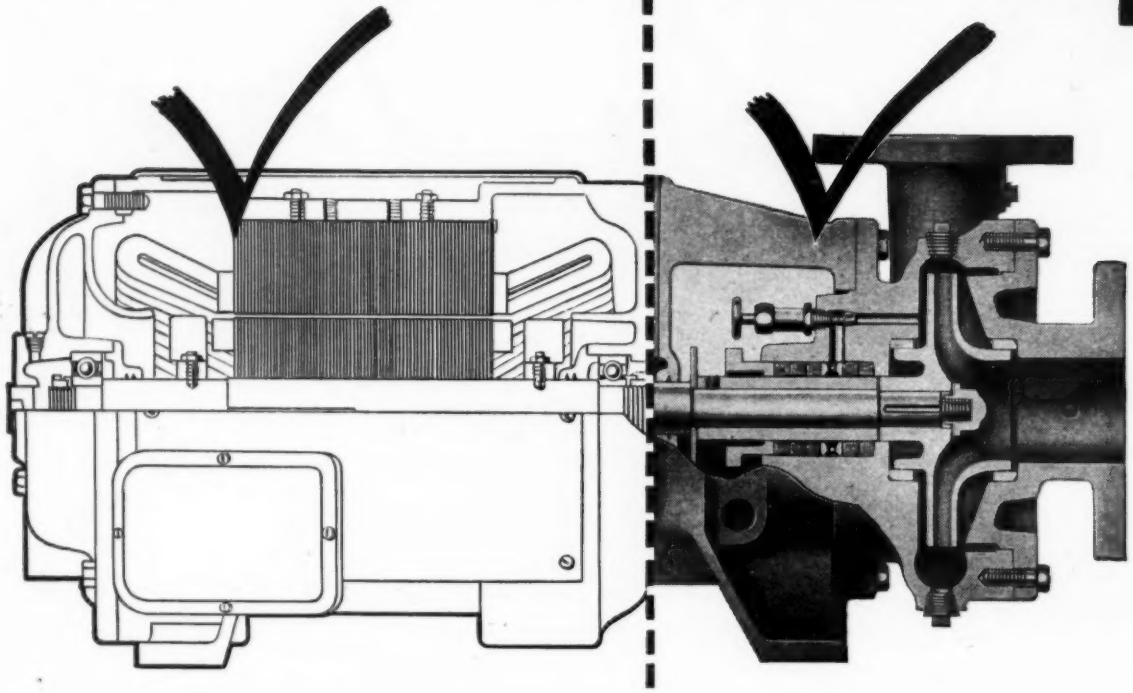
Please Send Descriptive Bulletin I-22

NAME .....

COMPANY .....

ADDRESS .....
P. W.

Motor *and* Pump



...combined

TO GIVE UNDIVIDED RESPONSIBILITY FOR CAPACITY... EFFICIENCY... HEAD

NOT ONE maker's pump hooked up to another maker's motor —but pump AND motor, designed and built as a unit by Allis-Chalmers.

There's no buck-passing. Allis-Chalmers backs every "Electrifugal" pump all the way — tests and checks the performance of each unit, at the factory.

FOR EVERY PUMPING NEED . . . CALL ON A-C

This versatile, popular "Electrifugal" pump is only part of the complete Allis-Chalmers line of centrifugal, axial and mixed-flow pumps — single or double suction, single or multi-stage, capacities up to 170,000 gpm. Call your A-C office or dealer — or write for bulletin B6018. ALLIS-CHALMERS, MILWAUKEE.

A2073

SPLASH-PROOF, LO-MAINTENANCE MOTOR — specially built for pump service. Sturdy, long-life rotor, interchangeable stator coils.

PUMP AND MOTOR IN ONE RUGGED FRAME, and on the same shaft. Result: perfect alignment; smooth, vibrationless operation; longer bearing life.

EASY INSTALLATION AND MAINTENANCE. Just hook up and pump . . . operates in almost any position . . . all parts easily accessible for checking and service.

SIZES FROM ¾ TO 25 HP meeting a wide range of requirements as to capacity, head, and fluids to be pumped.

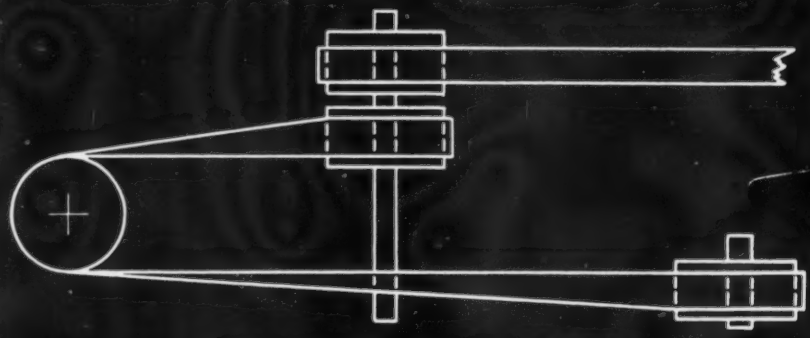
ALLIS-CHALMERS

★ One of the Big 3 in Electric Power Equipment
Biggest of All in Range of Industrial Products ★

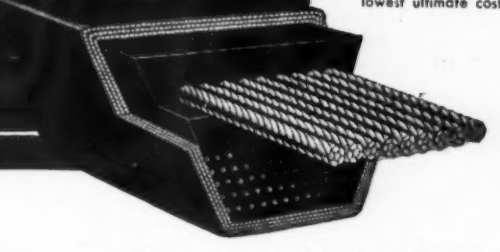
Electrifugal **PUMPS**

G.T.M.-Specified

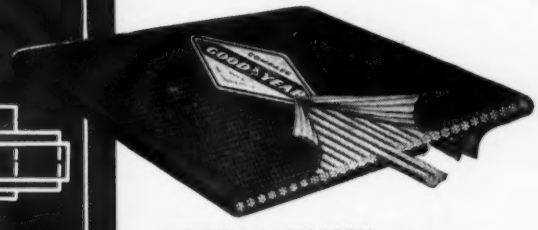
GOODYEAR INDUSTRIAL RUBBER PRODUCTS



MILL-PROVED MONEY SAVERS



Long, Trouble-Free Service with these Goodyear Dependables



ENDLESS COMPASS BELTS for compressors, generators, fans, line-shafts and other heavy-duty drives. In countless installations they have outlived and outperformed ordinary belts three and four to one.

EMERALD CORD AIR HOSE—a truly "super" air carrier. Lighter than ordinary hose, yet far tougher, stronger, longer lasting, thanks to new construction. Oil-resistant tube. Best buy for heavy-duty service.

E-C CORD MULTI-V-BELTS are uniform in length, cross section, pull and service life. Their perfect teamwork insures lowest ultimate cost.

HERE are three of a long list of Goodyear products that have won a notable reputation in industrial use. With them you get the economy, the dependability, the long-lived service that have made Goodyear rubber products first choice of industry for years.

And more — you get the expert counsel of the G.T.M. — Goodyear Technical Man. His on-the-spot specification gives you these superior products in the exact size and construction your problem requires. For more detailed information, why not consult the G.T.M.? Write: Goodyear. Akron 16, Ohio or Los Angeles 54, California.

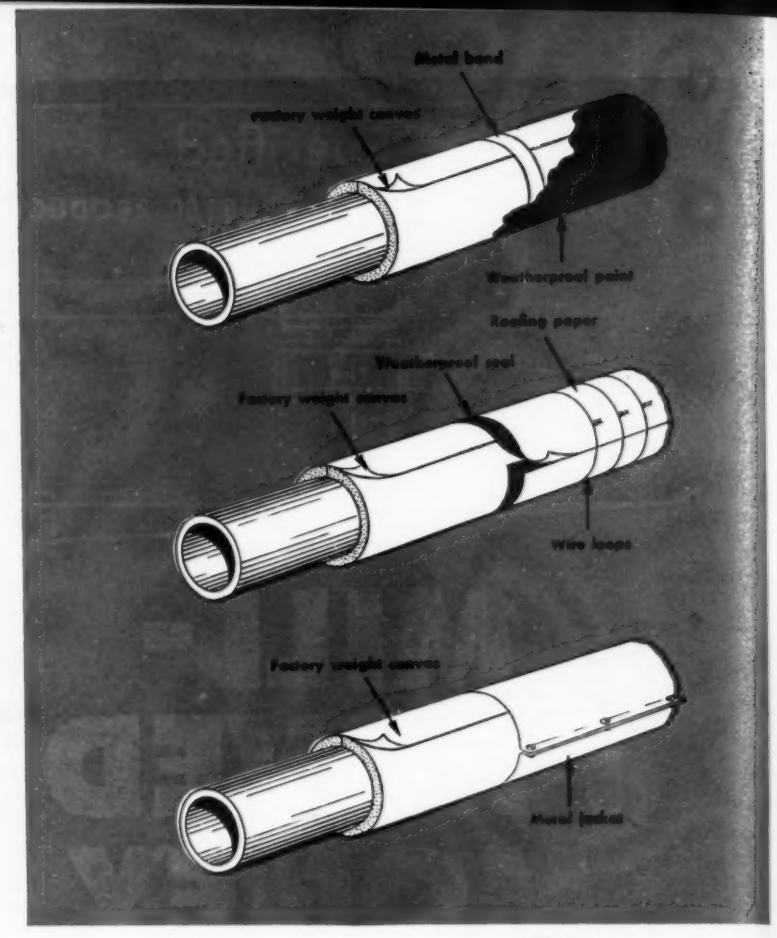
FOR HOSE, BELTING, MOLDED GOODS, PACKING, TANK LINING built to the world's highest standard of quality, phone your nearest Goodyear Industrial Rubber Products Distributor.

Compass, Emerald Cord, E-C Cord —T.M.'s The Goodyear T. & R. Co.

GOODYEAR

THE GREATEST NAME IN RUBBER

How would YOU protect this outdoor hot line?



Here's the problem: An 8" line carrying saturated steam at 250° F. is insulated with 85% Magnesia covering. The line is outdoors and exposed. The plant is located in the Midwestern section of the country. What method would you use to protect the insulation against the weather?

☐ PAINT? ☐ ROOFING PAPER? ☐ METAL JACKET?

The method to use depends upon geographical location and job conditions. In climates where weather conditions are very severe or on jobs where the insulation is subject to possible abrasion, extra protection is often necessary.

Painting directly over factory canvas, even with a weatherproof paint, does not provide sufficient protection for outdoor work. A layer of weatherproof paper is considered by most engineers to be practical for a majority of weather conditions. Or this type of weatherproofing can be used even in severe climates if the line is not subjected to other sources of possible damage. The paper should be securely wired in place with the lap at the side so as to form a watershed, and all joints should be sealed tightly with asphalt emulsion.

For outdoor lines that are exposed to bumping or abrasion, or to unusually severe weather, such as hard hail storms, the additional protection of metal jackets is often worth while. Metal jackets also are used in refineries and chemical process plants because the metal will not absorb inflammable gases and create a fire hazard.

Choosing the right method when there are several alternatives results in a superior insulation job. And Armstrong engineers have been trained to distinguish the relative merits of such possible close decisions. The same careful attention to all phases of the job—engineering, supervision, and workmanship — characterizes Armstrong's Contract Service. The next time you have a heat insulation job, talk it over with an Armstrong engineer in one of the offices listed below.

Free! New Insulation Chart

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write for your copy today to Armstrong Cork Company, Building Materials Division, 7002 Maple Avenue, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

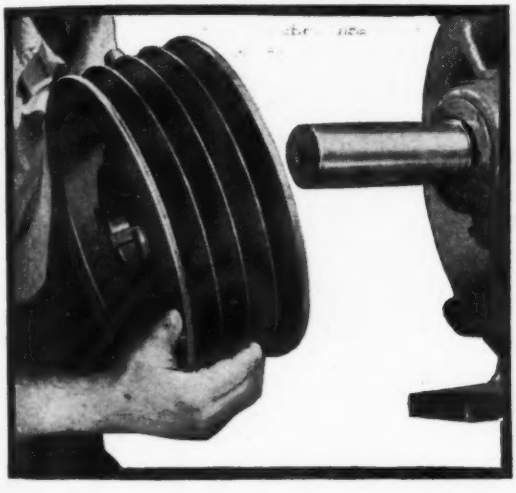
From 300° Below Zero — To 2600° Fahrenheit

ALBANY, N. Y. • ATLANTA, GA. • BALTIMORE, MD. • BIRMINGHAM, ALA. • BOSTON, MASS. • CINCINNATI, OHIO • CLEVELAND, OHIO
COLUMBUS, OHIO • DALLAS, TEXAS • DETROIT, MICH. • HARTFORD, CONN. • HOUSTON, TEXAS • INDIANAPOLIS, IND. • JACKSONVILLE, FLA.
KANSAS CITY, MO. • LOUISVILLE, KY. • MEMPHIS, TENN. • MILWAUKEE, WIS. • MINNEAPOLIS, MINN. • NEW ORLEANS, LA. • NEW YORK, N. Y.
PHILADELPHIA, PA. • PITTSBURGH, PENNA. • PROVIDENCE, R. I. • RICHMOND, VA. • ST. LOUIS, MO. • TULSA, OKLAHOMA • WASHINGTON, D. C.

Easy-Mounting, Fast-Locking Sheave

Pays Off

The First Time You Put It On!



"MAGIC-GRIP" *sheaves offer time-saving, money-saving features!*

EVEN if you install the sheave only once, and never change it again — it pays to get "Magic Grip" sheaves! For frequent changes, naturally, your savings pyramid.

- No filing or reaming. "Magic-Grip" bushing slides easily, even on oversize shafts.
- No hammering or forcing to damage motor bearings.
- No wheel puller needed to get the sheave off.
- No set screws to mar or score the shaft.
- No wobble or blacklash. "Magic-Grip" sheaves lock to shaft with shrunk-on grip.

HOW DOES IT WORK? Sheave and bushing come completely assembled. You just slip it on the shaft — align — and tighten three screws. *That's all!* And it comes off just as easily.

Standardize on time-saving, money-saving "Magic-Grip" sheaves. They're heavy duty, precision made and finely finished — the best sheaves you can buy . . . the best economy in the long run. Get them through your nearest A-C dealer or office.

ALLIS-CHALMERS, MILWAUKEE 1, WIS.

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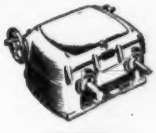
TEXROPE .. Greatest Name in V-Belt Drives

"Super 7" V-BELTS
Five Types — Sizes to suit every power transmission job.

Texsteel, Texdrive, "Magic-Grip"
— sheaves in a full range of sizes, grooves.

"Vari-Pitch" SHEAVES
Exact variations in speed, stationery or motion control.



SPEED CHANGERS
Speed variations up to 375% at the turn of a crank.

ENGINEERING
Finest V-Belt engineering talent in the world—at your call.

TEXROPE "Super 7" V-Belts result from the cooperative research of two great companies — Allis-Chalmers and B. F. Goodrich. They are sold only by A-C.

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

1847 1947 A CENTURY OF SERVICE to Industry THAT MADE America Great

TYPICAL REPUBLIC AUTOMATIC

SPREADER STOKERS

ALLIS-CHALMERS MFG. CO.
Springfield, Ill.
2 boilers: 68,000 lb./hr. each: 160 lb.

ALLIED CHEMICAL & DYE CO.
Chicago, Illinois
1 boiler: 45,000 lb./hr.: 125 lb.

BUICK AVIATION PLANT
Melrose Park, Illinois
1 boiler: 90,000 lb./hr.: 175 lb.

CHICAGO & NORTHWESTERN R. R. CO.
Green Bay, Wisconsin
2 boilers: 25,000 lb./hr. each: 125 lb.

DAIN MFG. CO.
Ottumwa, Iowa
2 boilers: 518 hp. each: 175 lb.

HUBINGER CO.
Keokuk, Iowa
1 boiler: 150,000 lb./hr.: 500 hp.

CLINTON ENGINEERING WORKS
Oliver Springs, Tenn.
3 boilers: 40,000 lb./hr. each: 300 lb.

CLINTON ENGINEERING WORKS
Clinton, Tenn.
3 boilers: 50,000 lb./hr.: 175 lb.

NORTHWESTERN YEAST CO.
Chicago, Illinois
1 boiler: 338 hp.: 140 lb.
2 boilers: 253 hp.: 140 lb.

MARSHALL CANNING CO.
Marshalltown, Iowa
1 boiler: 40,000 lb./hr.: 160 lb.

KRAFT FOODS
Hutchinson, Minn.
2 boilers: 316 hp. each: 150 lb.

KRAFT FOODS
Albany, Minn.
2 boilers: 338 hp. each: 160 lb.

PYRAMID COAL CORP.
Pinchnieyville, Illinois
3 boilers: 40,000 lb./hr. each: 210 lb.

WALWORTH CO.
Kewanee, Illinois
1 boiler: 60,000 lb./hr.: 200 l

SCHENLEY DISTIL
Lawrenceb
2 boi

GINGS CORP.
arbor, Indiana
oiler: 30,000 lb./hr.: 150 lb.

U. S. NAVAL TRAINING STATION
Farragut, Idaho
2 boilers: 412 hp. each: 100 lb.
2 boilers: 350 hp. each: 100 lb.
4 boilers: 250 hp. each: 100 lb.
2 boilers: 500 hp. each: 100 lb.

CHAIN GRATE STOKER

ADAMS & WESTLAKE CO.
Elcart, Indiana
2 boilers: 500 hp. each: 125 lb.

BETHLEHEM STEEL CO.
Bethlehem, Pa.
4 boilers: 600 hp. each: 160 lb.

THE BERYLLIUM CORP. OF PA.
Temple, Pa.
2 boilers: 22,500 lb./hr. each: 145 lb.

BLESSING HOSPITAL
Quincy, Illinois
1 boiler: 150 hp.: 100 lb.

CHICAGO, NORTHWESTERN R. R.
Chicago, Illinois
3 boilers: 45,000 lb./hr. each: 160 lb.

CLINTON PRODUCTS CO.
Clinton, Iowa
2 boilers: 25,000 lb./hr. each: 200 lb.

CORN PRODUCTS REFINING CO.
Pekin, Illinois
1 boiler: 175,000 lb./hr.: 400 lb.

HOUDAILLE HERSHEY CORP.
Decatur, Illinois
4 boilers: 25,000 lb./hr. each: 125 lb.

HOOSIER LAMP & STAMPING CORP.
Evansville, Indiana
1 boiler: 400 hp.: 150 lb.

MURRAY CORPORATION OF AMERICA
Scranton, Pa.
2 boilers: 35,000 lb./hr. each: 125 lb.

KREY PACKING
St. Louis, Mo.
1 boiler: 400 hp.: 350 lb.

ROCKFORD MITTEN & HOSIERY CO.
Rockford, Illinois
2 boilers: 400 hp. each: 110 lb.

U. S. RUBBER CO.
Passaic, New Jers
2 boilers: 40,0
2 boil

lb./hr. each: 125 lb.
32,000 lb./hr. each: 125 lb.

U. S. MARINE HOSPITAL
Klamaith Falls, Oregon
4 boilers: 500 hp. each: 100 lb.

REPUBLIC RUBBER DIVISION
Youngstown, Ohio
1 boiler: 65,000 lb./hr.: 450 lb.

ALUMINUM FORGINGS, INC.
Erie, Pa.
3 boilers: 50,000 lb./hr. each: 145 lb.

GRIESEDIECK WESTERN BREWERY
Belleville, Illinois
1 boiler: 600 hp.: 125 lb.

UNDERFEED STOKERS

EDWARD G. BUDD MFG. CO.
Philadelphia, Pa.
3 boilers: 100,000 lb./hr. each: 150 lb.

CHEVROLET MOTORS
Bay City, Michigan
1 boiler: 600 hp.: 150 lb.

INDEPENDENT PNEUMATIC TOOL CO.
Aurora, Illinois
1 boiler: 300 hp.: 300 lb.

THE OLD QUAKER CO.
Lawrenceburg, Indiana
2 boilers: 500 hp. each: 160 lb.

REO MOTORS, INC.
Lansing, Michigan
1 boiler 40,000 lb./hr.: 260 lb.

ST. JOHN'S HICKEY MEMORIAL HOSPITAL
Anderson, Indiana
2 boilers: 150 hp. each: 150 lb.

U. S. FINISHING CO.
Norwich, Conn.
1 boiler: 40,000 lb./hr.: 165 lb.

UPJOHN COMPANY
Kalamazoo, Michigan
1 boiler: 40,000 lb./hr.: 160 lb.

U. S. MARINE AIR STATION
Cherry Point, North Carolina
3 boilers: 55,000 lb./hr. each: 175 lb.

MILITARY VEHICLE & FU
Detroit, Michigan
3 boilers: 28,0

NG PLANT
lb./hr. each: 150 lb.

MBUS ASF DEPOT
Columbus, Ohio
1 boiler: 26,000 lb./hr.: 90 lb.

MUNICIPAL WATER & LIGHT PLANT
St. Marys, Ohio
2 boilers: 35,000 lb./hr. each: 235 lb.

TIMKEN ROLLER BEARING CO.
Columbus, Ohio
1 boiler: 60,000 lb./hr.: 400 lb.

U. S. MILITARY ACADEMY
West Point, N. Y.
2 boilers: 100,000 lb./hr. each: 160 lb.
1 boiler: 120,000 lb./hr.: 160 lb.

U. S. NAVY YARD
Charleston, S. C.
2 boilers: 20,000 lb./hr. each: 160 lb.

GEO. WIEDEMANN BWG. CO.
Newport, Ky.
1 boiler: 456 hp.: 125 lb.

REPUBLIC
Are Being
FOR ALL SIZES OF BOILERS AND

COMBUSTION CONTROL INSTALLATIONS

PULVERIZED COAL

BELTON MILLS
Belton, South Carolina
1 boiler: 60,000 lb./hr.: 250 lb.

BOECKELER ASSOCIATES
Trenton, Michigan
1 boiler: 528 hp.: 125 lb.

GEORGIA POWER COMPANY
Harryat, Georgia
1 boiler: 600,000 lb./hr.: 975 lb.

HARTFORD CITY PAPER COMPANY
Hartford City, Indiana
1 boiler: 80,000 lb./hr.: 325 lb.

CLINTON ENGINEERING WORKS
Oliver Spriggs, Tenn.
1 boiler: 750,000 lb./hr.: 1375 lb.

U. S. NAVY YARD
Portsmouth, Virginia
1 boiler: 120,000 lb./hr.: 380 lb.

WRIGHT FIELD
Dayton, Ohio
1 boiler: 100,000 lb./hr.: 300 lb.

N. Y., N. H. & HARTFORD R. R. CO.
Cos Cob, Conn.
1 boiler: 150,000 lb./hr.: 325 lb.

PRATT & WHITNEY
East Hartford, Conn.
2 boilers: 20,000 lb./hr. each: 175 lb.

U. S. MARINE BARRACKS
Quantico, Virginia
1 boiler: 120,000 lb./hr.: 125 lb.

CENTRAL ILLINOIS PUBLIC SERVICE CO.
Hutsonville Station
Hutsonville, Ill.
2 boilers: 150,000 lb./hr. each: 665 lb.

COMMONWEALTH EDISON CO.
Northwest Station
Chicago, Illinois
3 boilers: 425,000 lb./hr. each: 1325 lb.

NORFOLK NAVY YARD
Portsmouth, Va.
3 boilers: 120,000 lb./hr. each: 400 lb.

NORTHERN PAPER MILLS
Green Bay, Wis.
2 boilers: 75,000 lb./hr. each: 650 lb.

WILLIAMSBURG POWER PLANT
Brooklyn, N. Y.
2 boilers: 375,000 lb./hr. each: 875 lb.

OIL FIRED

BAY REFINING CORP.
Bay City, Michigan
1 boiler: 350 hp.: 245 lb.

FITCHBURG GAS & ELEC. LIGHT CO.
Fitchburg, Mass.
2 boilers: 120,000 lb./hr. each: 200 lb.

PHILADELPHIA NAVY YARD
Philadelphia, Pa.
2 boilers: 130,000 lb./hr. each: 175 lb.

U. S. NAVAL HOSPITAL
Oakland, California
5 boilers: 490 hp. each: 125 lb.

U. S. NAVAL MAGAZINE
Port Chicago, California
3 boilers: 210 hp. each: 125 lb.

U. S. NAVAL HOSPITAL
San Leandro, California
3 boilers: 500 hp. each: 135

CITIES SERVICE
Lake Cha
4 b

...hr. each: 250 lb.
...,000 lb./hr. each: 250 lb.

GAS FIRED

BEECH AIRCRAFT CORPORATION
Wichita, Kansas
2 boilers: 180 hp. each: 100 lb.

GULF POWER COMPANY
Pensacola, Florida
1 boiler: 230,000 lb./hr.: 875 lb.

GENERAL TIRE & RUBBER CO.
Waco, Texas
3 boilers: 16,000 lb./hr. each: 190 lb.

LONG-BELL LUMBER CO.
De Ridder, La.
3 boilers: 250 hp. each: 165 lb.

MATHIESON ALKALI WORKS, INC.
Lake Charles, La.
1 boiler: 420,000 lb./hr.: 925 lb.

MISSISSIPPI POWER CO.
Hattiesburg, Mississippi
1 boiler: 230,000 lb./hr.: 875 lb.

TIDEWATER ASSOCIATED OIL CO.
Avon, California
2 boilers: 100,000 lb./hr. each: 250 lb.

ABERCRAMBIE-HARRISON OIL CO.
Sweeney, Texas
4 boilers: 100,000 lb./hr. each: 250 lb.

COMBINATION FIRING

CROWN CENTRAL PETROLEUM CORP.
Houston, Texas
3 boilers: 75,000 lb./hr. each: 450 lb.
Gas & Oil

KOPPERS UNITED CO.
Kobuta, Pa.
1 boiler: 150 hp.: 165 lb.
Coal & Oil

STANDARD OIL CO. OF NEW JERSEY
Canton, New Jersey
1 boiler: 150,000 lb./hr.: 605 lb.
Gas & Oil

CITY PUBLIC SERVICE
San Antonio, T
1 boiler
1 b

...SET
...: 605 lb.

PUBLIC SERVICE BOARD
San Antonio, Texas
1 boiler: 275,000 lb./hr.: 200 lb.
1 boiler: 200,000 lb./hr.: 200 lb.
Gas & Oil

S & W FINE FOODS, INC.
Redwood City, California
1 boiler: 335 hp.: 105 lb.
Gas & Oil

UTAH OIL REFINING CO.
Salt Lake City, Utah
4 boilers: 65,000 lb./hr. each: 615 lb.
Gas & Oil

U. S. NAVAL OPERATING BASE
Norfolk, Va.
1 boiler: 125,000 lb./hr.: 400 lb.
Pulverized Coal & Oil

PENICK & FORD, LTD. INC.
Cedar Rapids, Iowa
1 boiler: 150,000 lb./hr.: 500 lb.
Gas and pulverized coal

STANDARD OIL CO. OF CALIF.
Richmond, Calif.
3 boilers: 125,000 lb./hr. each: 850 lb.
Gas, oil, acid sludge

LOUISIANA STEAM GEN. CORP.
(Gulf States Utilities)
Baton Rouge, La.
2 boilers: 500,000 lb./hr. each: 670 lb.
Natural gas, oil, pulverized cake, refinery byproducts

THE TEXAS CO.
Port Arthur, Texas
3 boilers: 300,000 lb./hr. each: 615 lb.
Oil and gas

CONTROLS
Specified
ALL TYPES OF FUEL FIRING

EQUIPMENT ★ ★ FACILITIES ★ PERSONNEL ★ EXPERIENCE ★
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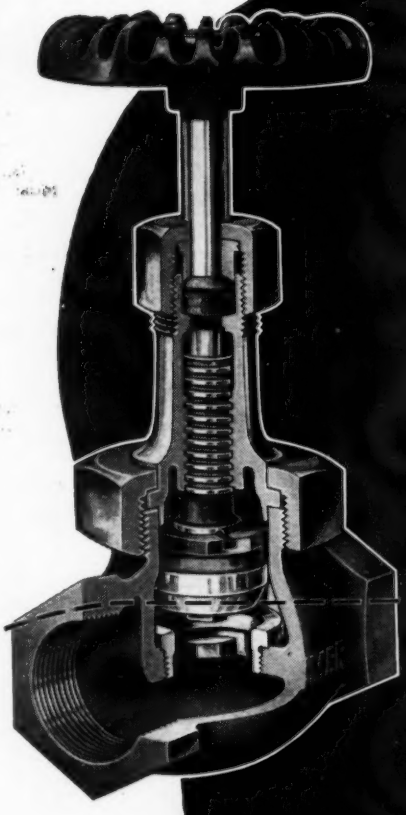
INSTRUMENTS
AND CONTROLS

REPUBLIC FLOW METERS CO.
2222 Diversey Parkway **Chicago 47, Illinois**



BRONZE "RENEWO" VALVES

REGULAR TYPE
Fig. 73....200 lb. S.P.
Fig. 16....300 lb. S.P.

PLUG TYPE
Fig. 73-P..200 lb. S.P.
Fig. 16-P..300 lb. S.P.

Here's all you need.... to convert a regular type into a plug type valve

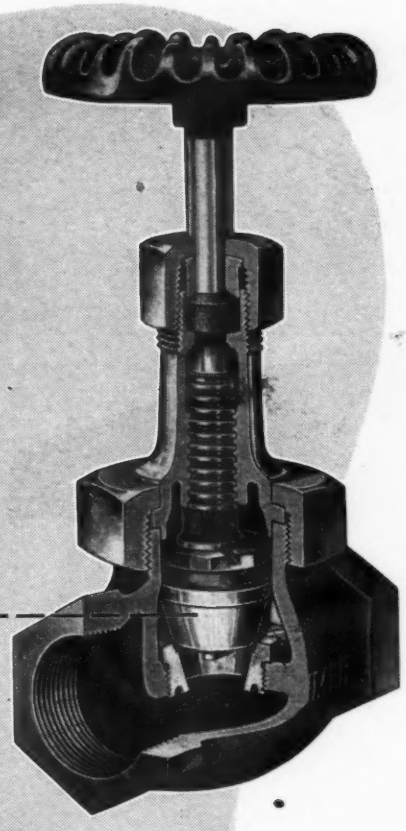
SEATS AND DISCS INTERCHANGEABLE*

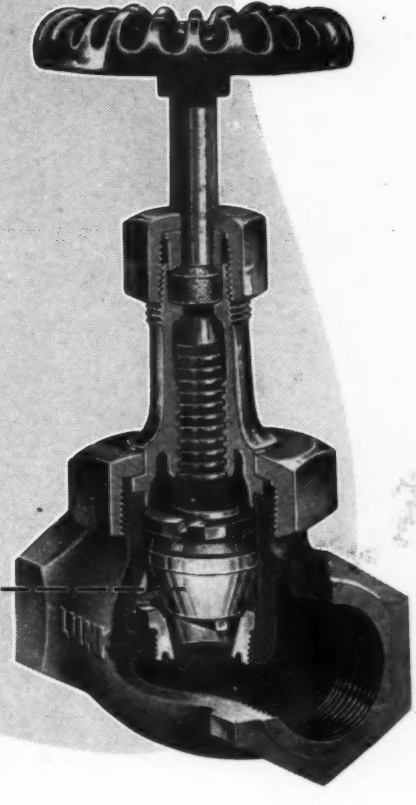
IRON BODY "FERRENEWO" VALVES

REGULAR TYPE
Fig. 1021...150 lb. S.P.

PLUG TYPE
Fig. 1021-P.150 lb. S.P.

LUNKENHEIMER VALVES ... *FASTER, EASIER,*





Just insert a plug type seat and disc in place of the regular type, and you change an *entire* Bronze "Renewo" Valve from regular to plug type—providing all the extra advantages of this type, including its ability to stand up under unusually hard service. *No* other change is necessary. The plug type seat-and-disc combination is made to *fit perfectly* into a regular type valve of corresponding size and pattern. And you have this same interchangeability in Iron Body "Ferrenewo" Valves. You don't have to buy an entire new valve . . . you don't even have to take the valve out of the line.

*Lunkenheimer interchangeability goes still farther. *All parts* of 200 lb. "Renewo" and 150 lb. "Ferrenewo" Valves (except bodies and bonnet rings) are quickly, easily, perfectly interchangeable. Fewer parts are needed; ordering and handling are simplified; repairs are facilitated. You save time, labor, money. Write for a copy of Circular 567—

LET YOUR LUNKENHEIMER DISTRIBUTOR DEMONSTRATE . . .

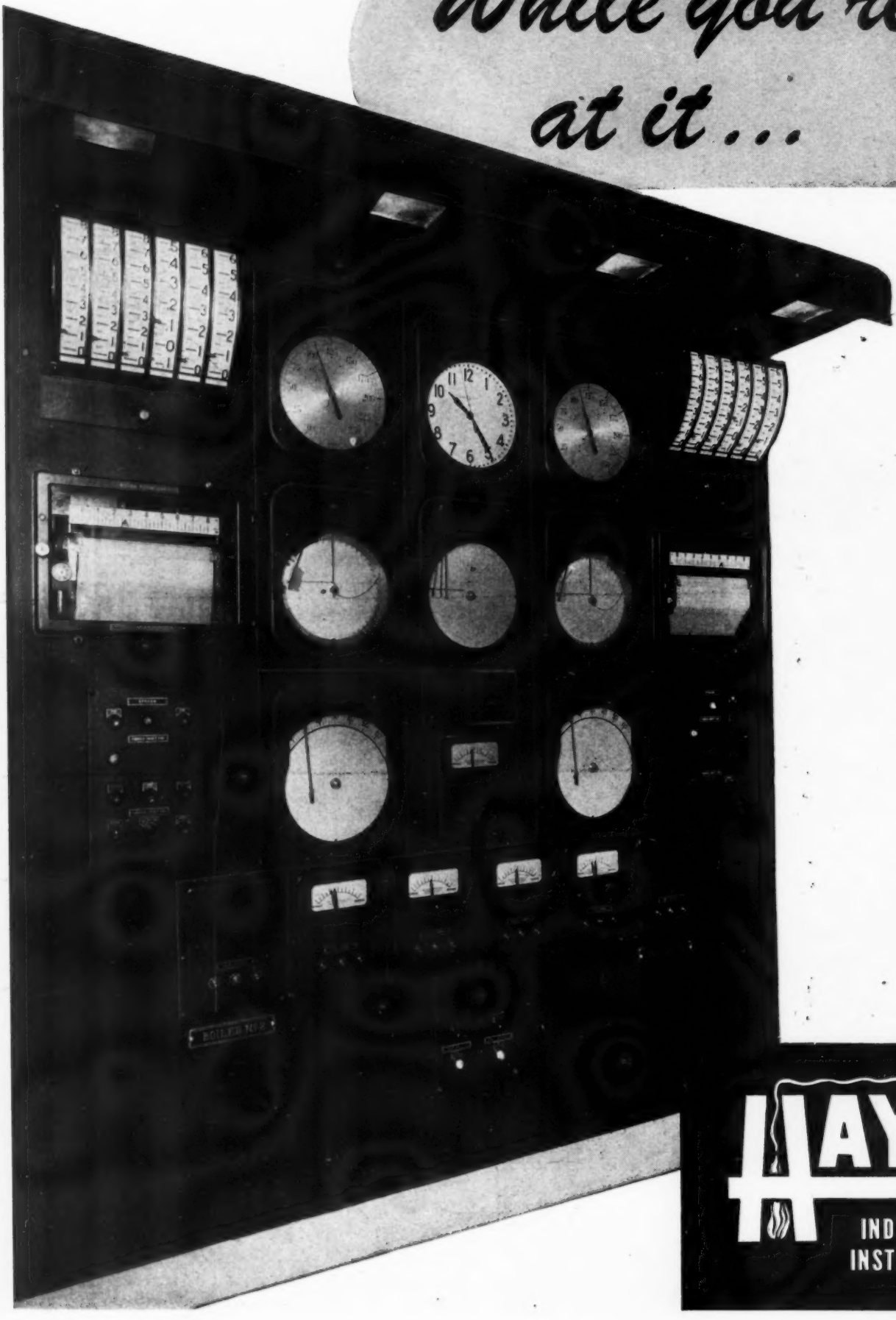
Your nearby Lunkenheimer Distributor will welcome the opportunity to show you actual samples and demonstrate the interchangeability of parts in "RENEWO" and "FERRENEWO" Valves. You'll find it a big factor in increasing efficiency, lowering costs.

THE LUNKENHEIMER COMPANY

CINCINNATI 14, OHIO, U. S. A.
NEW YORK 13, CHICAGO 6, BOSTON 10, PHILADELPHIA 7.
EXPORT DEPARTMENT: 319-322 HUDSON ST., NEW YORK 13, N. Y.

LOWER--COST MAINTENANCE!

While you're at it...



HAYS
INDUSTRIAL INSTRUMENTS

PUT IN THIS MODERN SYSTEM—

HAYS Automatic COMBUSTION CONTROL

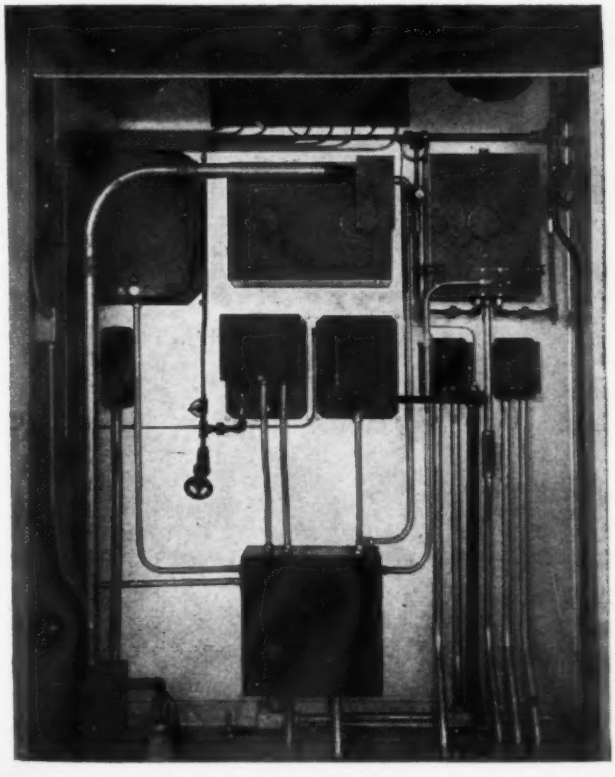
it's Electrical

ACCURATE, SIMPLE, DEPENDABLE, Hays centralized automatic combustion control is the truly modern method.

It is wholly electrical. Every combustion variable is measured accurately and corrected instantly. Sensitive contacts are operated by enclosed mercury switches—no possibility of moisture or dust; no sticking, chattering or excessive wear. Adjustments are made direct—no dependence on air pressures, oil pressures and intricate valve systems required in non-electrical designs. It is easy to install, easy to operate, easy to maintain.

For full details write for Bulletin 46-605—contains schematic drawings of 14 typical installations.

THE HAYS CORPORATION
Michigan City, Indiana



These six potent features tell a quick convincing story of Hays advantages:

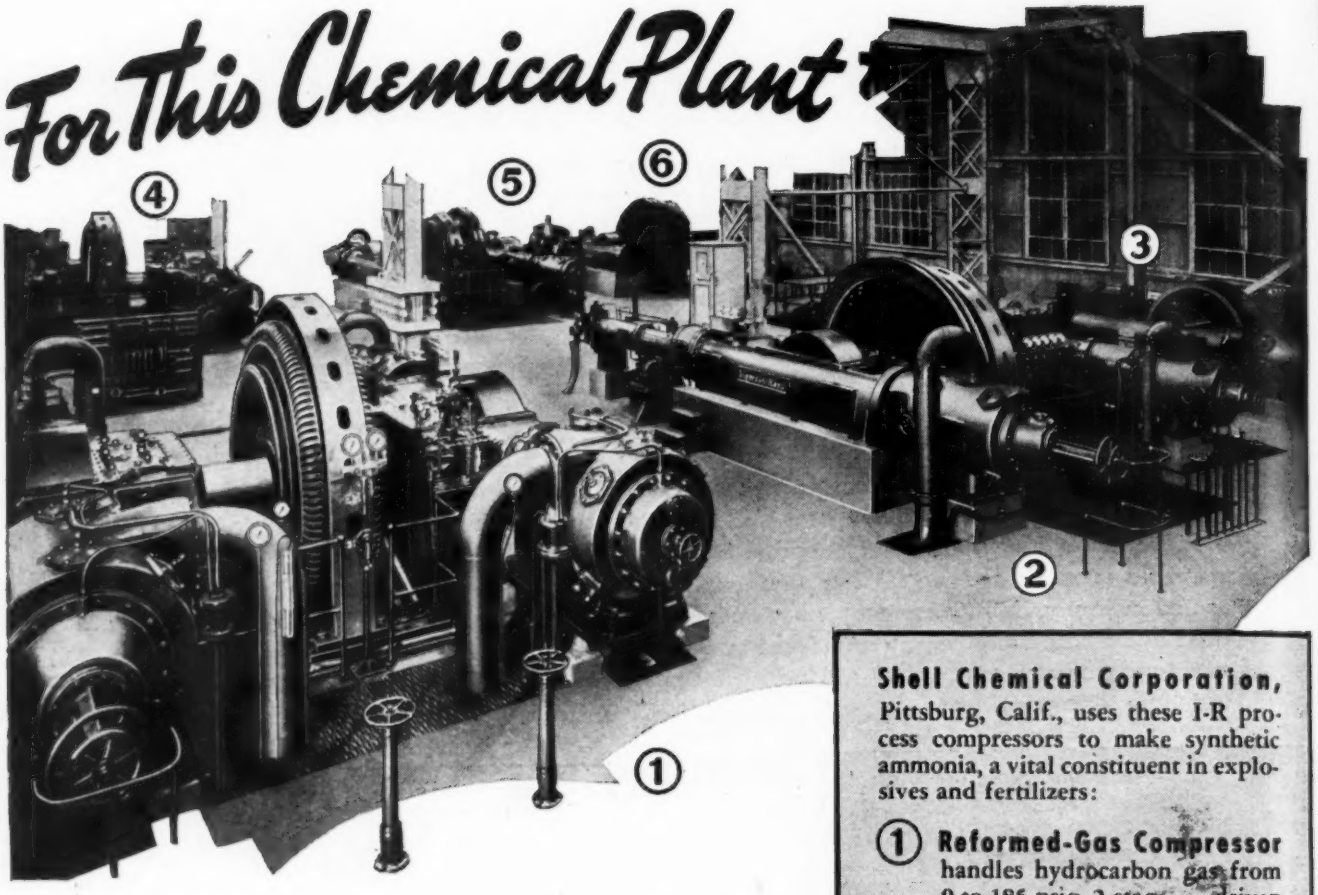
1. **All Electric operation.**
2. **Simple, positive, modern.**
3. **Easy for operators to understand, operate, maintain.**
4. **For all sizes of steam generating systems burning *any kind of fuel.***
5. **A thoroughly engineered installation by a Hays representative . . . Hays engineer representatives in all principal cities.**
6. **Every variable is accurately measured and proper corrections made *instantly*—electrically.**

View is of panel from the rear with access doors open to show the workmanlike wiring and the accessibility of all instruments and controllers. This type of fine workmanship is standard with Hays.

Automatic **COMBUSTION CONTROL**

INDUSTRIAL CONTROL · FLOWMETERS · GAS ANALYZERS · DRAFT GAGES · CO_2 RECORDERS

For This Chemical Plant



Shell Chemical Corporation, Pittsburg, Calif., uses these I-R process compressors to make synthetic ammonia, a vital constituent in explosives and fertilizers:

1. **Reformed-Gas Compressor** handles hydrocarbon gas from 0 to 185 psig, 2-stage . . . driven by a 1000-hp motor.
2. **Nitrogen Compressor** operates at 0 to 3000 psig, 5-stage . . . 600-hp motor.
3. **Ammonia Compressor . . .** 3 to 141 or 4.7 to 208 psia, 3-stage . . . 200-hp motor.
4. **Air Compressor . . .** 0 to 850 psig, 3-stage . . . 600-hp motor.
5. **Mixed-Gas Compressor** handles nitrogen and hydrogen . . . 145 to 3000 psig, 3-stage . . . 1000-hp motor.
6. **Circulator Compressor** handles hydrogen, nitrogen, ammonia . . . discharging up to 3000 psig, single-stage . . . 900-hp motor.

A maximum over-all plant economy was attained by making many of the frame, running-gear, cylinder, and motor parts interchangeable. Note the 4-corner construction (cylinder on each end of each frame) which provides maximum accessibility.

Each Compressor was built to do a definite job

These six I-R process compressors differ in the gases handled, the pressures generated, the horsepower required, and the operating characteristics. Each was engineered and built to perform its particular job with a high degree of dependability, with a saving in horsepower, and with an ease of operation and control.

Ingersoll-Rand has built the compressors for many synthetic ammonia plants all over the world, as well as for other processes and for handling all kinds of gases. Among these compressors are seven 2500-hp electric-driven seven-stage units compressing nitrogen and hydrogen gas to the super pressure of 15000 psi.

With such *experience* in building and applying compressors for process work, and with a standard line of air and gas compressors from ½ to 3000 horsepower designed for flexibility of application, there is a pretty good chance that Ingersoll-Rand has already built the kind of compressor needed for *your* process. If not, this *know-how* will serve as a background in meeting any new requirements you may have. Remember, Ingersoll-Rand can help solve your compressor problems.

SEVENTY-FIFTH IR ANNIVERSARY

COMPRESSORS • AIR TOOLS • ROCK DRILLS
TURBO BLOWERS • CONDENSERS
CENTRIFUGAL PUMPS • OIL AND GAS ENGINES

Ingersoll-Rand

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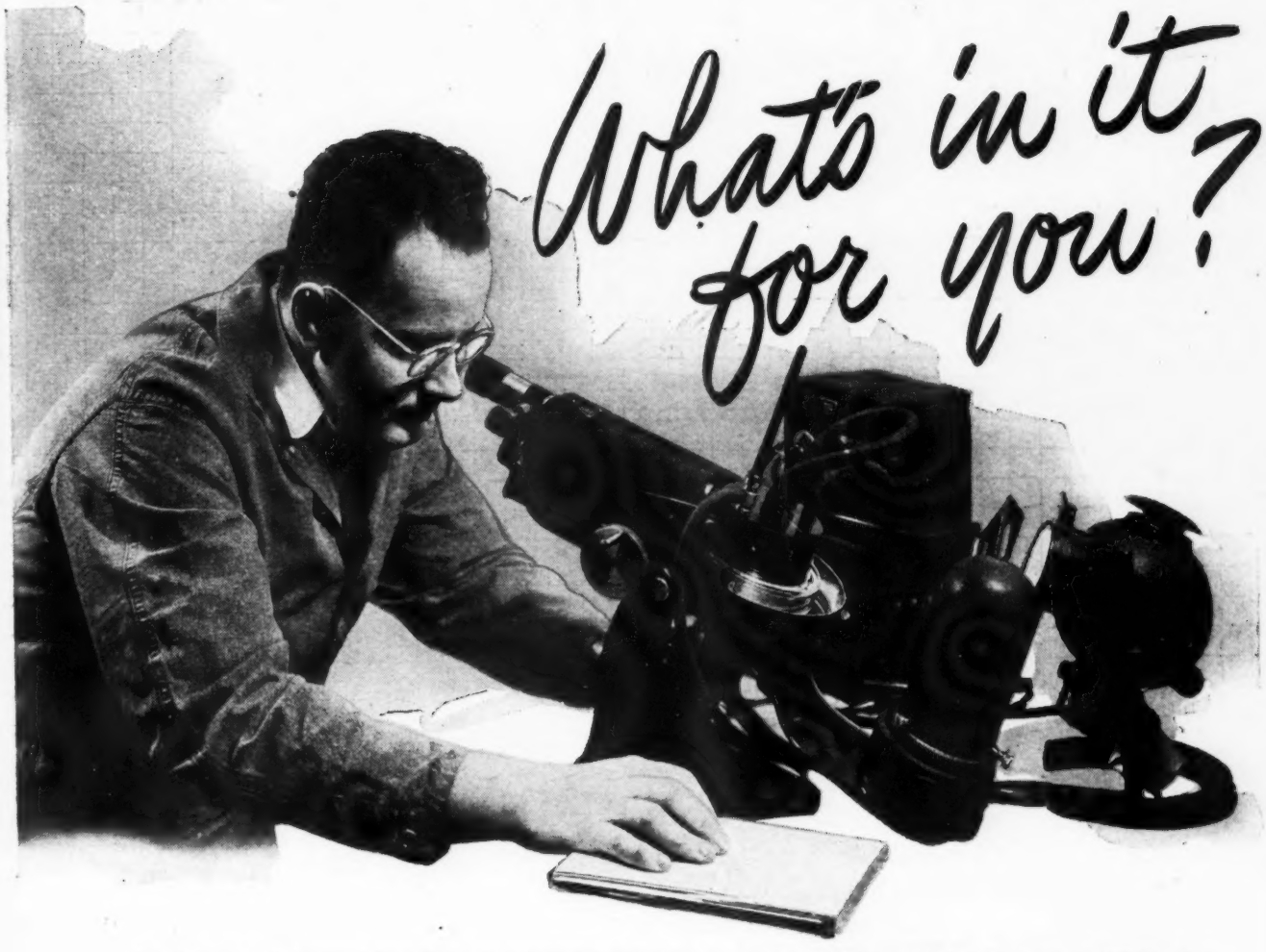

In this special machine there's plenty for you as a user of industrial lubricants. With the modern Refractometer, Sinclair Laboratory specialists keep posted on what's in your industrial lubricants. It shows them what properties to strengthen, so the finished product will perform best in any specific application.

Index of refraction and specific dispersion, determined by the Refractometer, is a measure of the chemical structure of lubricating oils. By use of such instruments as the Refractometer, Sinclair maintains important control points in the manufacture of dozens of industrial lubricants.

Such laboratory research and control gives you assurance that Sinclair lubricants are made correctly to provide the kind of special protection your valuable machinery requires.

Sinclair Lubricants for the Power Plant

For Turbines:
SINTURLITE OILS
For Steam Cylinders:
SINCLAIR STEAM CYLINDER AND VALVE OILS
For Compressors:
RUBILENE OILS
For General Lubrication:
COMMANDER OILS
For Ball and Roller Bearings:
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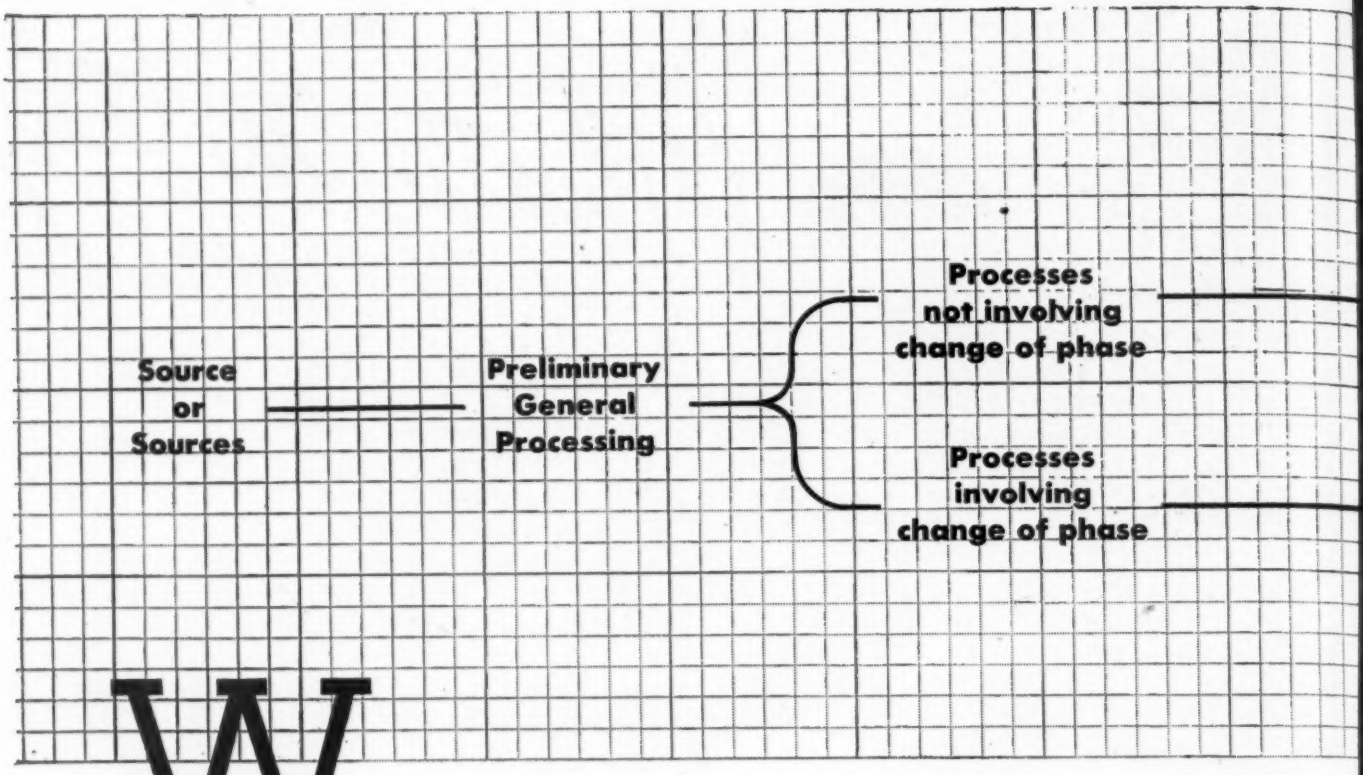
Lubricants for Industry

FINEST CRUDES + EXPERT RESEARCH and MANUFACTURING CONTROL = OUTSTANDING PERFORMANCE


Source or Sources
Preliminary General Processing
Processes not involving change of phase
Processes involving change of phase

Water Problems neither *begin*

In the modern industrial plant, water presents serious problems, not only in the boiler but at every point in its path from source, through power plant or factory to final disposal.

The accompanying diagram gives a rough approximation of this path, but no diagram can show the almost infinite variations in detail. Nor can a diagram even suggest the problems which arise at every point, and the intricate cross-relationships between problems.

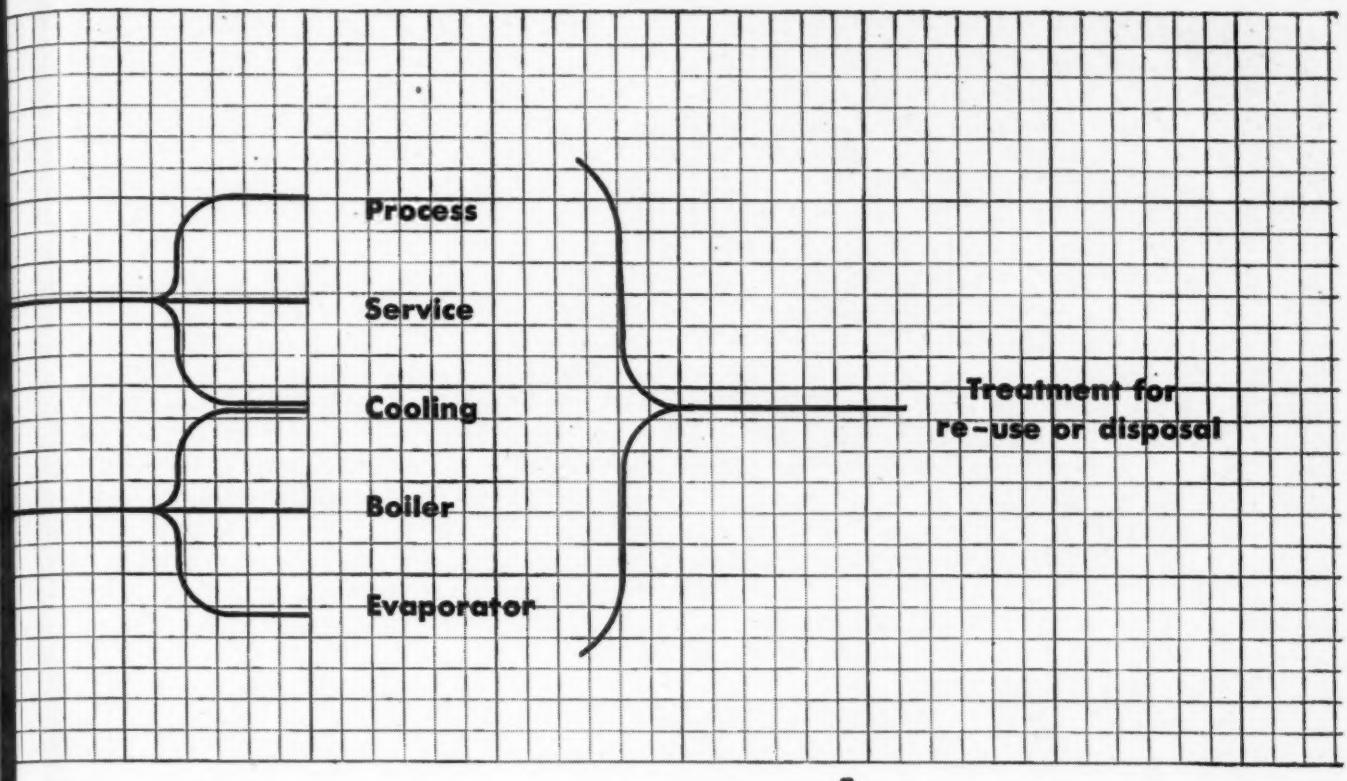
SOME TYPICAL PROBLEMS

These problems begin when planning of the plant begins. Water requirements must be analyzed in detail. The amounts of water needed for steam generation, for the various plant processes and for general factory service must be determined. The characteristics of water for each use must be specified.

Water sources must be studied. How much water can be made available? From what sources? What are the characteristics of the available waters? Is there possible contamination from other plants? Should separate water systems be set up or should water from all sources be combined? Are algae or chemical-forming bacteria present in harmful amounts?

Is any preliminary treatment of the entire supply required? What types of treatment?

HALL SYSTEM *of Boiler Water Conditioning*



nor *end* at the boiler

These are just a few of the questions that arise, and their answers are interwoven with other problems. Characteristics of the water will determine methods of treatment; amounts of water available will influence the selection of a cooling system; supply, characteristics, and contamination during use will be factors in determining methods of purification for re-use or disposal.

Economic considerations are always present. Solutions of a sort may be relatively easy. The major problem is to devise appropriate inter-related procedures which, giving due weight to investment, operating expense and maintenance cost, establish the most efficient and economic balance for the specific situation.

SCOPE OF HALL SERVICE

Every one of these problems comes within the scope of Hall Laboratories. More than twenty years ago, Hall entered this field by introducing the Hall system of boiler water conditioning. This system—maintenance in the boiler of certain essential chemical equilibria—is now standard practice.

During its existence, Hall Laboratories has steadily expanded its activities. It has serviced thousands of plants, and has continued fundamental research not only in boiler water conditioning but in all phases of industrial water conditioning.

Hall Laboratories is at your service in connection with any problem pertaining to the use of water in industrial plants.

HAGAN
HALL
BUROMIN
CALGON

HALL LABORATORIES, INC.
(A subsidiary of Hagan Corporation)
HAGAN BUILDING, PITTSBURGH 30, PA.

For trouble free flow control ...install POWELL Valves

There are at least two notable reasons why Powell Valves minimize flow control troubles. One is that every valve in the Powell Line has been scientifically designed to operate under certain specific flow control conditions—pressure, temperature and/or media. The other is that there's a Powell Valve for *every* operating condition, or set of conditions, known today.

That's why so many plants, representing every phase of modern industry, are now standardizing on Powell Valves.

Class 900-pound 14" Cast Steel non-return Globe Valve, with pressure seal bonnet and welding ends. Compound spur gearing for easy operation.

POWELL

Fig. 241—125-pound Iron Body Bronze Mounted Globe Valve. Has flanged ends, outside screw rising stem, bolted flanged yoke, and regrindable, renewable bronze seat and disc. Also available in All Iron.

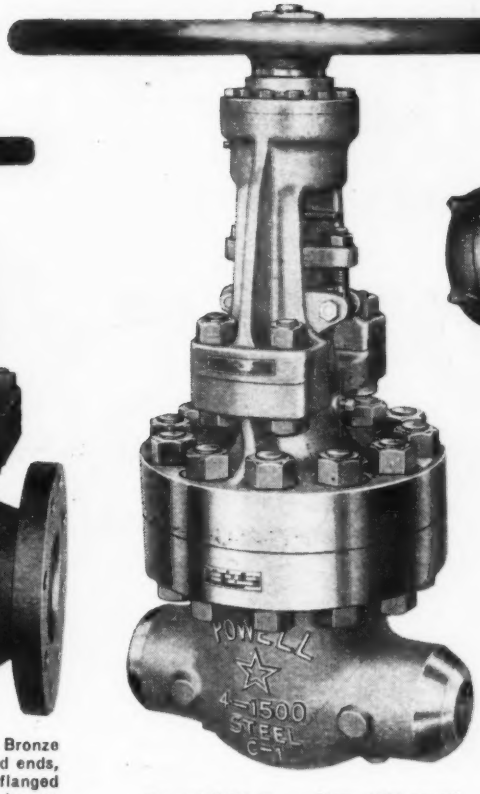


Fig. 1303 W. E. — Class 1500-pound Cast Steel Gate Valve, with welding ends, outside screw rising stem and bolted flanged yoke.

Class 1500-pound 8" Cast Steel Gate Valve with welding ends, welded bonnet and special by-pass. Top mounted electric motor operator assures quick, positive opening and closing by remote control.

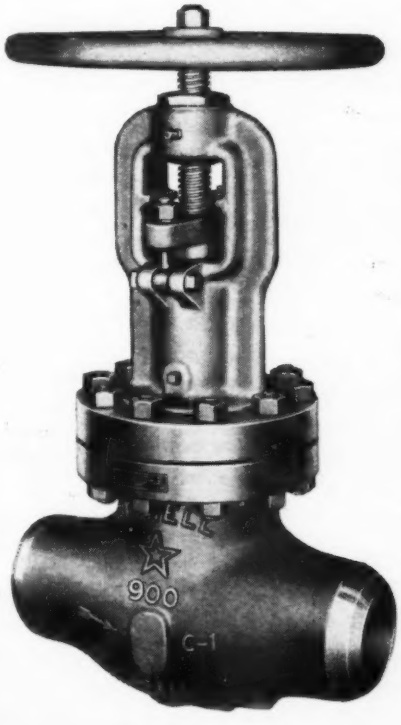


Fig. 9031 W. E.—Class 900-pound Cast Steel Globe Valve, with welding ends, outside screw rising stem and bolted flanged yoke.

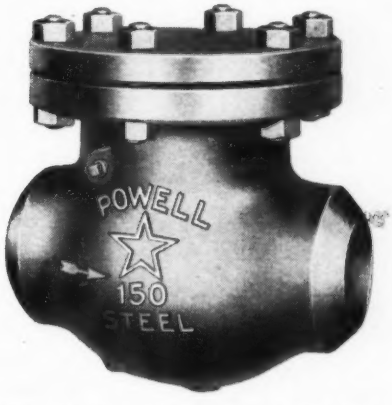


Fig. 1561 W. E.—Class 150-pound Cast Steel Swing Check Valve with welding ends and bolted flanged cap.

The Wm. Powell Company

Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

VALVES

INTRODUCING—Two New E

ROTO AIR JET

The world's most powerful and economical tube cleaner

ROTO Air JET Motor Model 525 with swing-frame head and universal joint for 2⅝" I.D. curved tubes.

Gives you AT LEAST 100% more power, and 60% less air consumption per hp than previous Roto motors

What jet propulsion did for speed in aviation, the new ROTO Air JET does for tube cleaning.

Laboratory tests, backed by service in the field, show that ROTO Air JET Tube Cleaners, size for size, are the most powerful ever built. Air consumption per horsepower is much lower. The increase in power and efficiency is even more pronounced on the larger sizes. For instance, the new ROTO Air JET Model 525 for 2⅝" I.D. curved tubes is 263% more powerful than the old Roto Model 125, and uses 80% less air per hp.

Extensive aerodynamic research with the porting and timing of the simple but practical Rotocentric principle for tube cleaner motors is responsible for the almost unbelievable performance of the new ROTO Air JET Motor. The performance curves shown here were obtained after the ROTO Air JET was throttled down to only a fraction of its maximum power to suit average tube cleaning requirements.

ROTO Air JET Tube Cleaners are now available for most common tube sizes. Other sizes are being added rapidly. Present Roto heads and operating hose will fit the new motors.

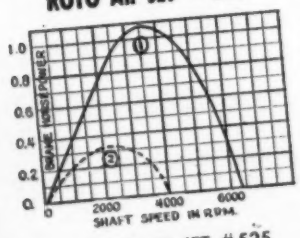
The longer it now takes to clean your tubes, the more it will pay you to get a new ROTO Air JET. Once you try it, no other tube cleaner will ever satisfy you.

Send for details and prices.

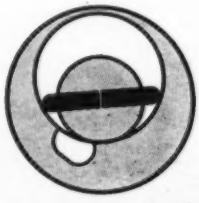
AIR CONSUMPTION
per brake HP
ROTO Air JET #505

1—Old Roto #105
2—Best competitive motor
3—ROTO Air JET #505

BRAKE HP vs SPEED
ROTO Air JET #525



1—ROTO Air JET #525
2—Old Roto #125



Simple Rotocentric (egg-shape) bore motor has only two moving parts, a shaft and blade whose edges constantly maintain close contact with the cylinder, permitting minimum air leakage and maximum utilization of air.

Extraordinary Tube Cleaners

ROTO WATER JET

The most powerful and economical water-driven tube cleaner ever built

Gives you MORE THAN **100% increased power, and 80% less water consumption per hp than previous Roto equipment**

The new ROTO Water JET now makes it possible, for the first time, to remove the most stubborn scale quickly and effectively with a water-driven tube cleaner. No other water-driven tube cleaner motor ever built develops such great power, and so economically.

A radical design change in the turbine wheel and other parts, based upon recent developments in hydrodynamics, is responsible for superior performance of the new ROTO Water JET Motor. See the graph. For instance, the new ROTO Water JET Model 321 for 2¼" I.D. straight tubes develops 107% more power at 130 psi than the former Roto Model 21, and uses 80% less water per horsepower.

Some of the first ROTO Water JET Tube Cleaners were loaned to local plants for field tests. Not one of the users wanted to return them to us for examination without a promise that we would give them priority on the first regular shipments.

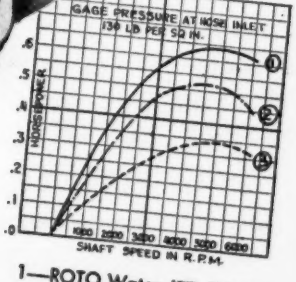
ROTO Water JET motors are now being made for the most popular tube sizes. Other sizes will be available shortly. Existing Roto heads and operating hose fit the new motors.

The time, labor, and water it saves will soon pay for your new ROTO Water JET Tube Cleaner, and you will get a much cleaner job than with any water-driven cleaner you ever had.

Send for details and prices.

ROTO Water JET Motor Model 321 with short 4-arm head and universal joint for 2¼" I.D. straight tubes.

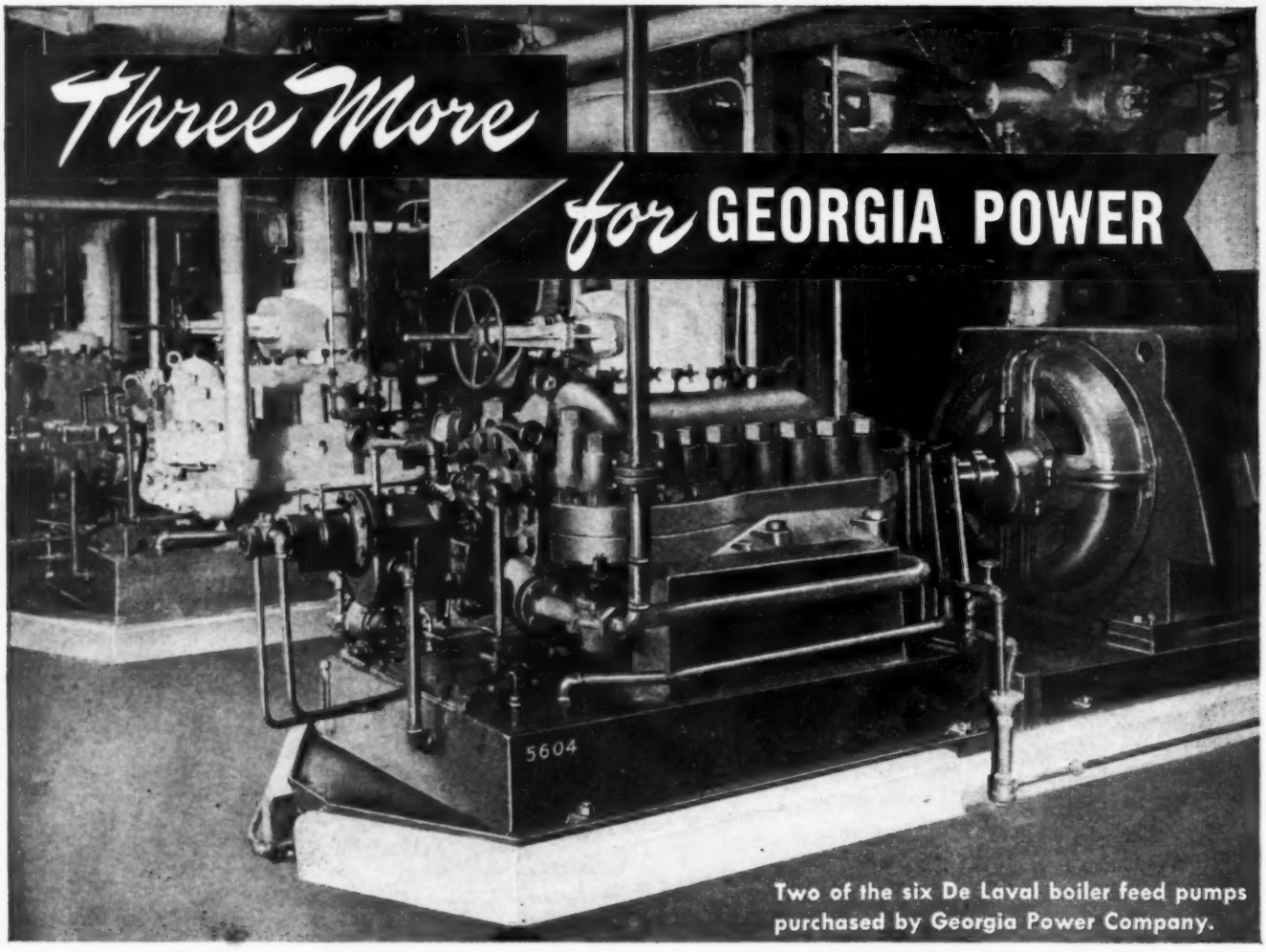
BRAKE HP vs SPEED ROTO Water JET 321



1—ROTO Water JET #321
2—Best competitive motor
3—Old Roto #121

ELLIOTT COMPANY-ROTO DIVISION

153 Sussex Avenue, Newark 1, N. J.



Two of the six De Laval boiler feed pumps purchased by Georgia Power Company.

Reliability of DE LAVAL Boiler Feed Pumps Demonstrated in HIGH PRESSURE Service

Three De Laval high pressure boiler feed pumps were purchased by the Georgia Power Company several years ago. Their performance has proved so satisfactory that subsequently three more De Laval units were ordered. Each of the latest units has a capacity of 1455 gpm. against 1013 psi discharge at 1770 rpm., handling 316° F feed water.

The satisfactory performance of De Laval pumps in high pressure service is due, among other things, to the rigidity of De Laval solid end head construction, the automatic action of the De Laval hydraulic balancing arrangement, and the leak-minimizing effect of De Laval Labyrinth Wearing Rings.

In other installations De Laval boiler feed pumps have proved their dependability handling high temperature feed water at pressures of up to 1600 psi.

TURBINES · HELICAL GEARS · WORM GEAR SPEED REDUCERS · CENTRIFUGAL PUMPS · CENTRIFUGAL BLOWERS AND COMPRESSORS · IMO OIL PUMPS

DE LAVAL STEAM TURBINE COMPANY
TRENTON 2, NEW JERSEY

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TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
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PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

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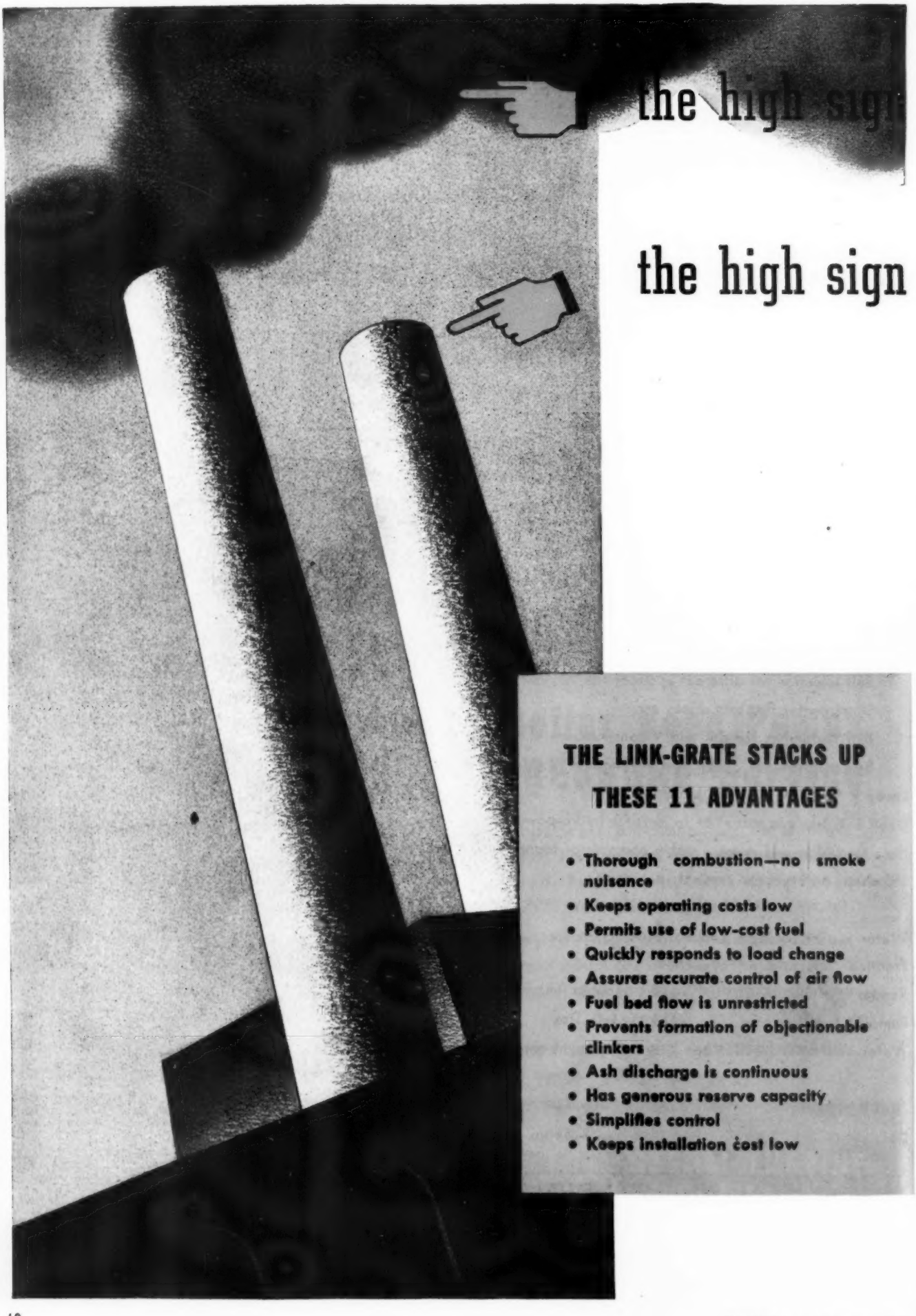

the high sign

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Efficient combustion

of a *Link-Grate* stoker

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You'll get less smoke—and, of course, more power—per pound of coal with a Westinghouse Link-Grate Stoker. That's been proved in one installation after another . . . and it's a fact that will win approval from your own fuel cost sheets, from the Smoke Inspector and your neighbors.

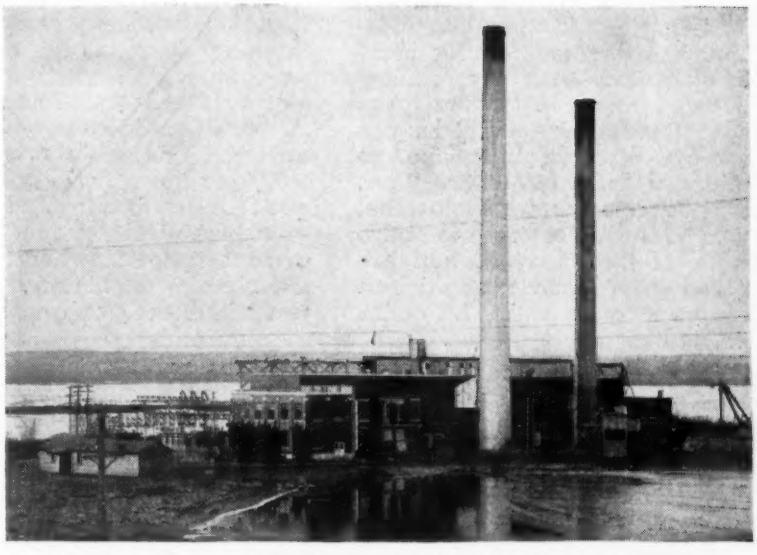
The Link-Grate action does all this by maintaining a regular combustion rate because it continuously processes the fuel bed to keep it porous. With this action, positive motion at the rear of the stoker permits uniform flow of coal over the underfeed section to keep the burning lanes open.

In Link-Grate action, the grates first hinge up to break open the fuel bed and let low pressure air flow through the grates. The reverse movement of the grates crumbles and conveys the burning fuel.

Because of this conveying movement of the Link-Grate, ash comes off the ash discharge plate continuously—doing away with periodic dumping and reducing labor. Clinkers are not a problem.

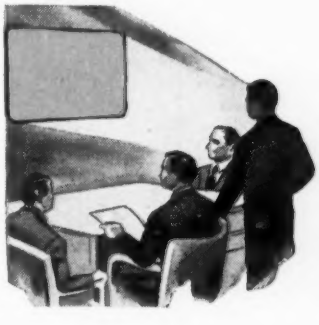
Since the fuel bed is always porous, the Link-Grate Stoker can meet suddenly increased steam demands quickly with full combustion efficiency.

Get the complete information about the Link-Grate before you make an investment in stokers. If possible, see one in operation. Your nearest Westinghouse office will be glad to arrange an appointment with a user. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-50469



Almost no smoke is coming out of the stacks although the boilers are in operation at this power plant of the Lake Superior District Power Co. at Ashland, Wisconsin. In this installation are two 6-retort, SDL-29 Link-Grate Stokers. (Photograph is not retouched.)

Show Link-Grate Movies in Your Own Office. A 15-minute sound moving picture has been produced to show in detail the operation of a Link-Grate Stoker. Whether you can visit an actual Link-Grate Stoker in operation or not, this interesting 16 mm. film will show you its action and explain its points of superiority while you sit at your desk. To borrow a print of this film for your own private showing, write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.



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Link-Grate **STOKERS**

Do Snow-bound Driveways Maroon Your Plant?

Try a Snow Melting System with

BYERS WROUGHT IRON PIPE

The "Winter-proofed" driveway at the American Cyanamid Company plant, Bridgeville, Pa., suggests an ingenious solution to a problem that is frequently encountered.

A two-lane, 600-foot roadway runs up-grade from the parking area to the main thoroughfare, and the lightest fall of snow, or the least bit of icing, would cause complications. The engineers—after hearing of the success of Byers Snow Melting Systems in loading areas and side walks—installed 8 lengths of Byers Wrought Iron Pipe, so positioned as to locate two pipes 18-inches apart under each wheel track. The runs extend the entire length of the roadway, and are welded into 4-inch wrought iron headers at each end. The entire system is embedded in an 8-inch concrete slab.

Water, with anti-freeze solution added, is heated to 165°F. in a steam-fed converter, and circulated by pumps. The system is designed to handle 1-inch of snow, or 0.1-inch of ice, per hour.

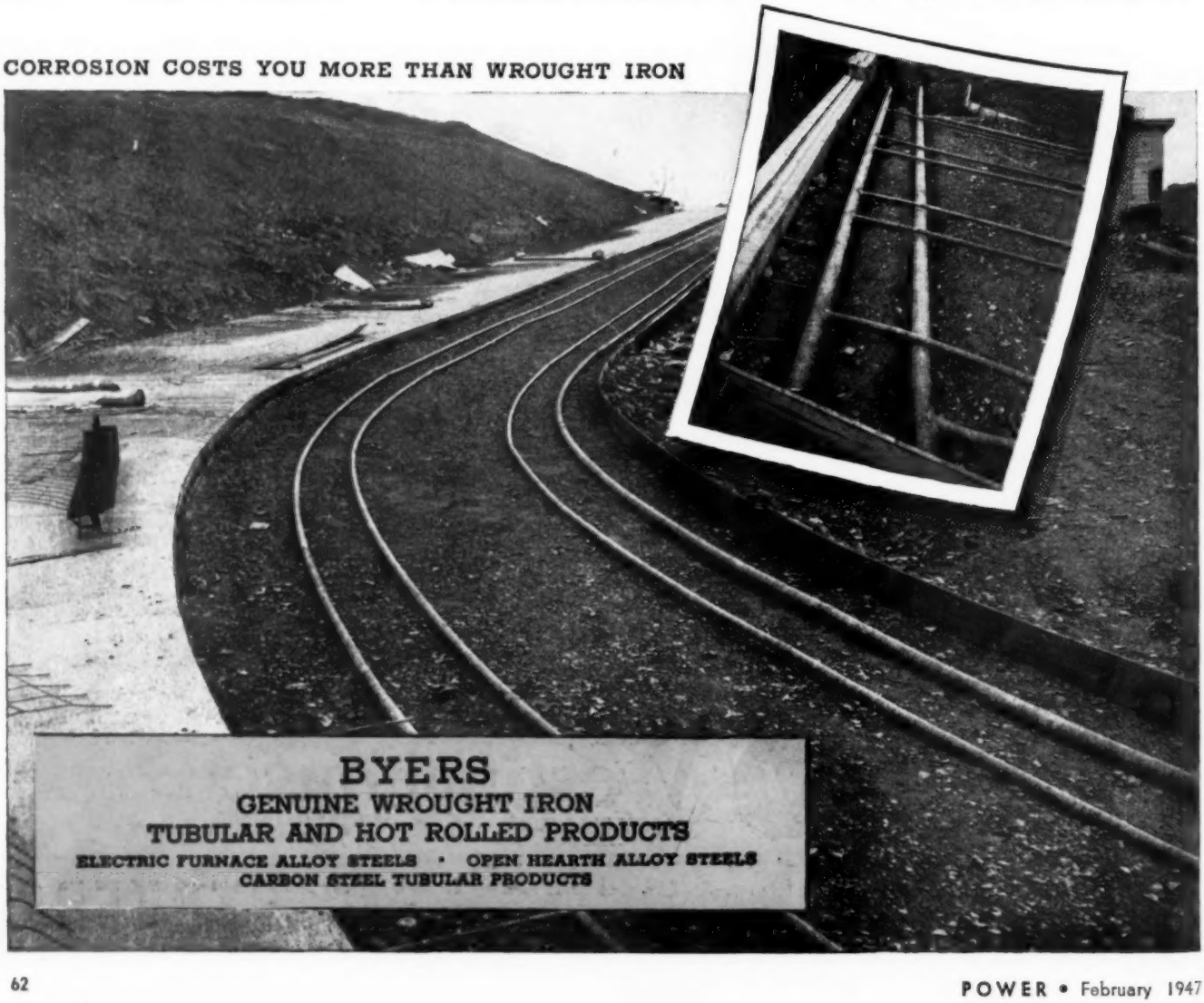
The question of corrosion had an important bearing in designing the driveway itself, as the engineers were anxious to avoid the use of a gravel foundation. Tests made by A. M. Byers laboratory revealed acid soil in certain areas. After weighing the opposing factors . . . good drainage provided by the grade, the alkaline properties of the cement, and the known corrosion-resistance of wrought iron . . . the slab was laid directly on graded earth.

Superior corrosion resistance is only one of the special advantages that make wrought iron so desirable for snow melting installations. The material is readily formed and welded, which speeds and simplifies installation. Its rate of heat emission is high. And it expands and contracts at practically identical rates with concrete, which helps guard against thermal cracks and loss of bond.

You will find some helpful information on snow melting in our Case Study No. 4, "A Study of Snow Removal." Ask for a copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON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GENUINE WROUGHT IRON
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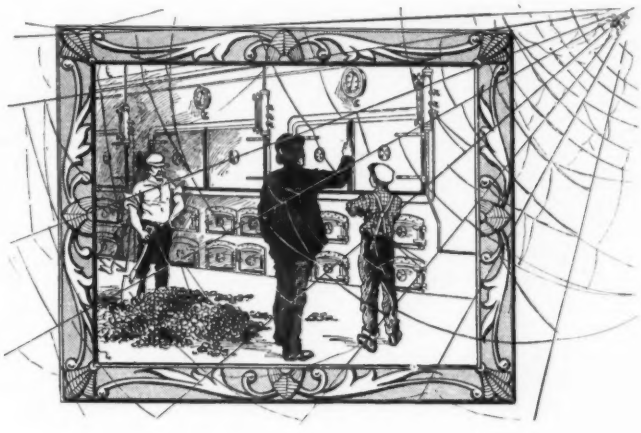
POWER

PHILIP W SWAIN, EDITOR • FEBRUARY 1947 • ESTABLISHED IN 1882



Let's Kill 'Boiler Horsepower'

WHILE EVERYDAY ENGINEERING has a proper place for rough-and-ready rules of thumb, there is a practical limit to quaintness in such matters. The day is long past when it was sensible to imply that two boilers had equal "power" because they had equal water-heating surfaces.

In all engineering there is no more nonsensical unit than "rated boiler horsepower"—each such "horsepower" being merely ten square feet of heating surface, good or bad.

This horsepower rating is much sillier even than the so-called "developed boiler horsepower"— another bastard unit, but at least a definite measure of true output—34½ lb steam per hour "from and at 212 F" or equivalent.

Disguising plain square feet of metal to look like steaming capacity is like rating a football player by his weight.

For us to lash out against boiler horsepower in 1947 may seem like a present-day tirade against the horse and buggy of a bygone age. It's true that the phony unit lost its professional standing a quarter century ago, that never since have POWER'S editors used the term except to deride it. Buyers and sellers of large boilers completely discarded this useless antique long ago. They buy and sell steam-generating capacity, not "horsepower."

Yet the boiler horsepower lives on year after year in its last stronghold—the field of small industrial boilers. The makers and users of such equipment still stumble through the day's business with a capacity yardstick that gets more useless and confusing with each passing year.

One recently added factor of confusion is the small, packaged steam generator burning gas or oil. This boiler can usually generate more steam per square foot than an hrt. Rating both hrt and packaged unit on the traditional basis of ten square feet per horsepower would be unfair to the packaged unit. To avoid this unfairness many makers rate their packaged boilers in terms of the maximum boiler horsepower they can deliver. This, in turn, is unfair to the hrt, which can generally deliver at least 50% more than its rated horsepower.

Some day all this absurd nonsense must crash of its own weight. Why not give it a shove right now? The initiative must come from the manufacturers. Let them play up actual steaming capacity, announce the square footage under its right name, do everything possible to insure present unpopularity and an early death for "boiler horsepower." May she rest in peace!

This editorial was ignited by William Gaylord's letter on page 124 of this number.

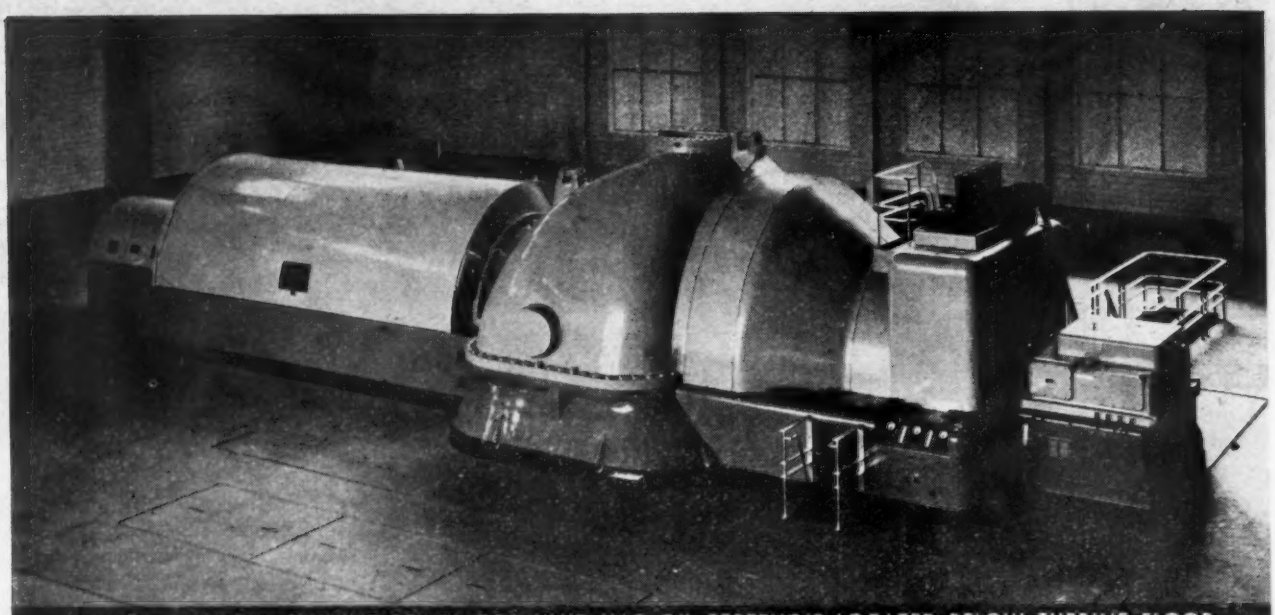


FIG. 1—MODERN TURBINE-GENERATOR UNIT HAS OIL RESERVOIR LOCATED BELOW TURBINE FLOOR

Turbine-Shaft Centrifugal Oil Pump Works With Oil-Driven Booster Pump

Continued reduction in turbine-rotor inertias and placing of turbine-oil reservoir well below the turbine level have markedly influenced design of pressure oiling systems, supplying bearings and speed-governing systems for these units

BY R SHEPPARD AND J W BARNETT
Turbine-Generator Engrg Div, General Electric Co

▶ INCREASING STEAM PRESSURES and temperatures and rotor speeds, combined with design refinements, have produced through the years a steady reduction in the rotating inertia per kw of capacity for the modern steam turbine-generator unit. Corresponding increase in the rotor-acceleration rate demands a faster-moving servomotor for operating the steam-inlet valves to realize satisfactory governing.

These conditions dictate increased pressure-oil pump capacity to care for rapid governing requirements. The trend, on the other hand, toward lighter rotor weights per kw capacity, with smaller bearings and decreased oil needs, calls for smaller pressure-oil pump capacities. These diverging trends have resulted in oil-capacity demands for the governing mechanism that are three times the bearing needs, the first being of momentary duration.

Oil-Reservoir Location. Small units of early vintage had their oil reservoirs at the turbine front end above the floor level, as a part of turbine frame or base. As unit size and length increased, inadequate drainage from the remote generator bearings compelled designers to lower the oil level 24 to 30 in. below the floor, and place the tank top at or near the floor line.

This location provided the drain-line slope necessary to avoid oil-vapor nuisance around the bearings. Even so, the long compound units presented a problem since manufacturers and operators favored submerging awkward and unsightly oil lines below the floor where they are out of sight. Foundation designers were obliged to compromise their structure to favor the drainage problem.

Both problems are solved by locating the oil tank 10 to 35 ft below the turbine. Oil lines may drop straight down inside foundation beams, avoiding long horizontal runs close under the turbine, and aid in relieving piping congestion.

Very early central-station units had the oiling-system elements set up separately outside the oil tank—all connected by a network of pipes. The oil cooler might be 50 to 100 ft from the turbine, hanging on the station wall. Auxiliary pumps were either in the basement or on the turbine-room floor beside the units. Drippage from connecting oil lines caused continuous trouble and annoyance.

The next development centralized the oil tank and its accessories to reduce piping to a minimum, and to drain nuisance drippage from pump glands

and valve stems into the tank. All turbine manufacturers have adopted close grouping of pressure-oil-system accessories. Placing the unit oil tank at the turbine-floor level, however, did little to relieve piping congestion in front of and around the turbine. Oil-cooler water heads had to extend above the tank top; steam standby pumps and regulators had to project above the tank top along with operating handwheels. These devices made accessibility to the turbine difficult. In addition station service pipes, carrying water to coolers and steam to standby pumps, created a complex snarl around the turbine front, detracting from appearance.

Transferring the oil reservoir to the basement has permitted turbine manufacturers to retain and perfect the compact oil systems. Oil coolers remain inside the oil tank, but at the lower level where service water and condensate headers find their natural runs and other service lines may be tapped conveniently. This results in the clean and trim appearance of the modern turbine-generator, Fig. 1. Removal of pumps, vapor extractors, auxiliary motors and reduction gears has contributed considerably to quieter running. These benefits are all obtained without sacrifice in operating and maintenance accessibility.

Fire Prevention. The oil reservoir contains all pressure-oil piping, fully shielding high-temperature steam piping against oil spray or drippage. Drain and guarding lines must be run from reservoir to bearings. Locating the reservoir below all main- and extraction-steam lines gives reasonable assurance that oil from an accidentally broken drain line cannot pour on high-temperature piping and burst into flame. Accident records show that such spillage constitutes one of the principal causes of turbine-oil fires.

Lubricating oil bursts into flame almost instantly with bare-pipe temperatures of 760 F and, under certain conditions, slightly lower.

PRESSURE-OIL SYSTEMS

Geared Slow-Speed Pump. Fig. 2 shows an arrangement with slow-speed positive-displacement pumps, driven from the turbine-generator by a worm-and-gear reduction. The long shafts, usually in two or three sections solidly coupled together, are inclosed in an oil-tight vertical duct that supports the lineshaft bearings and serves as a drain line, returning oil from the front-bearing housing back to the reservoir. Location of the latter in the basement depends on whether turbine or generator end drives the worm-and-gear reduction.

Oil delivered by the main pumps discharges into line 2-3 at about 200 psig regulated by spring-loaded relief valve 3. All pumped oil passes through relief valve 3, and down line 4, but a large portion may be diverted through relief valve 7 because it is excess not needed by the bearings.

Main oil-pump capacity may be three times the amount needed for bearings as determined by the servomotor's rapid governing needs. During rapid governor action all oil, previously passing through 200-psig relief valve 3, instantly bypasses through servomotor circuit 9-10. This scheme accomplishes fast servomotor operation and assures uninterrupted oil flow to the bearings, but the pumps handle large quantities of oil to care for a condition occurring infrequently, and then only for a fraction of a second.

Motor-Driven Oil Pumps. A more recent system uses one continuously running motor-driven centrifugal main pump, Fig. 3. Oil from the reservoir at the lower level is pumped through circuit 1-4-5-6 in quantity just sufficient to supply bearing needs, plus a slight regulating flow through low-pressure relief valve 7. Adjustable orifice 4 meters this flow and reduces oil pressure to about 40 psig.

Oil velocity in the line to the servomotor remains at essentially zero during all steady-state conditions although oil pressure at about 200 psig is established. During rapid governor action, oil in lines 2 and 9 accelerates when the servopilot suddenly opens. Pump-oil flow expands from normal bearing flow to perhaps three times normal by virtue of the centrifugal-pump normal head-flow characteristics, Fig. 6.

Shock-relief valve 3 at top of line 2 normally remains closed. It opens only momentarily to avoid oil hammer in the long line when the servomotor stops suddenly.

Only two pressure-oil lines need be run from the pump in the reservoir to the front-bearing housing although the line supplying the servomotor must be relatively large in diameter. A maintenance advantage is the spare motor pump, duplicate of the main motor pump. Either may be lifted from the reservoir top for inspection while the main prime mover is in service. This is done by closing a gate valve and removing a ring of bolts around the pump base at the reservoir cover without disturbing pipe flanges and thereby interrupting operation.

The motor's squirrel-cage rotor slips on over the top end of pump shaft so the pump's two pressure-lubricated sleeve bearings support the motor. The single-stage pump impeller fastens to the lower end of vertical shaft, making a mechanically simple and highly reliable pump.

A regulator automatically starts a quick-starting steam-driven standby pump in case of power loss to the main

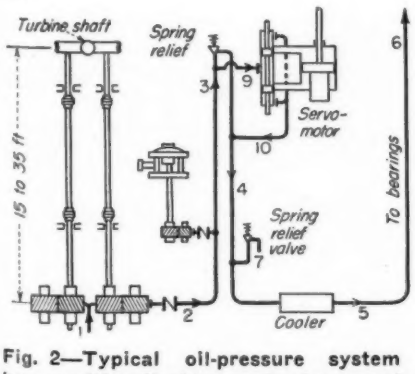


Fig. 2—Typical oil-pressure system has positive-displacement slow-speed oil pumps driven by worm-wheel reduction from turbine-rotor main shaft

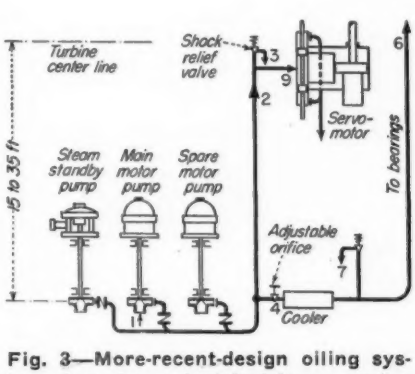


Fig. 3—More-recent-design oiling system has two electric-driven pumps, either one of which may be removed for repair without shutting down unit

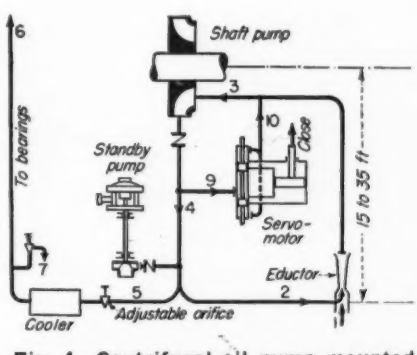


Fig. 4—Centrifugal oil pump mounted on turbine shaft supplies its own positive suction pressure by means of eductor located in the oil reservoir

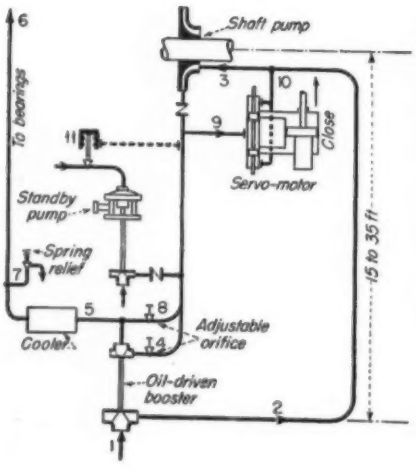


Fig. 5—Newest oil-pressure system uses series oil-driven booster pump to supply positive suction pressure for turbine-shaft-mounted oil-supply pump

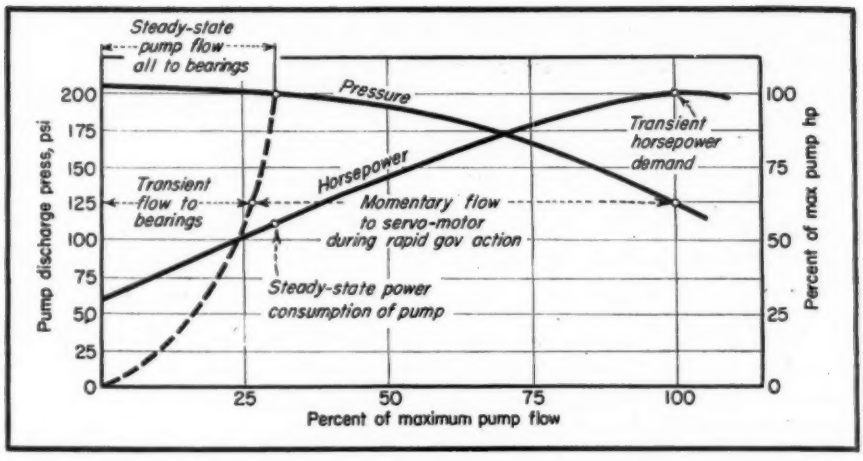


Fig. 6—Under normal steady-state conditions turbine-shaft oil-pump discharge pressure is 200 psig with pump flow about 30% of maximum. During rapid governor action, pump flow increases to maximum with pressure dropping to 125 psig. Bearing-oil flow decreases only slightly; this lasts fraction of second

motor pump without interfering with the prime-mover operation. Restoring main motor pump to service automatically shuts down the steam standby pump.

Shaft Pump With Eductor. Fig. 4 shows a pressure-oil system having a single-stage centrifugal pump with impeller mounted directly upon the turbine shaft. An eductor in the reservoir, at lower level, continuously primes the pump suction by maintaining a small positive pressure. The shaft pump raises oil pressure to that needed for powering the servomotor and related mechanisms. Oil flows from the pump down line 4 where a substantial part diverts through line 2 to the eductor. The adjustable orifice meters the balance of oil flow through the bearing-oil circuit.

Oil-flow rate into the eductor from the reservoir about equals the metered flow to the bearings except for minor leakages. Oil-flow rate through the main-shaft pump is considerably larger because of the oil needed in recirculating circuit 4-2-3 to activate the eductor in lifting oil from the reservoir.

During rapid governor action, flow through servomotor circuit 9-10-3, jumps from zero to several hundred gallons per minute to effect rapid closing of steam-inlet valves with pressure oil as the force medium. The centrifugal pump's inherent pressure-flow characteristics, Fig. 6, automatically cause this momentary flow increase. Passages through pump impeller and circuit 3-9-10 are large to accommodate high transient-volume flow.

A standby pump starts the system in the usual manner by initiating oil flow through the bearing circuit and filling suction line 3, thereby establishing the main-pump suction pressure and pressure in line 4 up to the closed check valve. The standby pump also provides high-pressure oil for moving the servomotor.

As the prime-mover speed increases from standstill, shaft-pump oil pressure builds up until it equals pressure on outside of closed check valve. At normal speed check valve opens, starting oil flow through circuit 1-3-4. Standby pump then gradually backs down to standstill as its regulator closes off the steam supply with slight rise in oil pressure determined by shaft-pump normal speed.

New Pressure-Oil System. American manufacturers successfully use the three arrangements discussed. All have interesting features and proved reliability. A new arrangement, however, has been developed using a smaller-capacity centrifugal-type pump, turbine-shaft mounted, primed by a high-efficiency oil-driven booster pump in series with the shaft-mounted pump, Fig. 5. On 3600-rpm turbine-generators a single-stage impeller is mounted near the prime-mover shaft end adjacent to the journal and thrust bearings, Fig. 8.

A compact oil-turbine-driven booster pump, under the oil level in the tank, Fig. 7, supplies the shaft-mounted pump with a 10-to-20-psig suction pressure. Oil discharging from the shaft-mounted pump at 200 psig passes down through the vertical line, Fig. 5, through a small 1500- to 1800-rpm oil-turbine wheel. This oil gives up power as pressure reduces to 30 or 40 psig before it passes through the oil cooler on its way to supply the bearings at a final total pressure of 25 psig.

Servomotor 9 and other mechanisms operated by high-pressure oil require no continuous oil flow except for minor leakages. Therefore, oil flow pumped through circuit 1-2-3-4-5-6 may be controlled by the adjustable orifices to equal the bearing needs exactly, plus a small regulating flow through relief valve 7.

A gallon of light turbine oil passing through the oil turbine wheel, dropping in pressure from 200 to 40 psig, has available energy between two and three times that needed to pump a gallon of oil up suction line 1-2, holding 20 psig at the impeller suction, including booster efficiency. Consequently only about half the bearing oil flow is allowed to pass through booster oil-wheel circuit 4-5, the balance going through bypass 8. This favorable efficiency balance in the booster provides (1) desirable and flexible means for wide adjustment of suction pressure to care for variations in elevations and suction-line drops (2) independent adjustment of system flow 1-2-3-4(or 8)-5-6 to meter additional flow needed for the bearings. Opening needle valve 4 increases oil flow through the oil wheel and the power increase speeds up the booster and raises pressure at the shaft-pump suction. Adjusting bypass needle valve 8 provides the additional flow, supplementing the booster-wheel flow to meet exactly the bearing-orifice needs, plus the small relief-valve flow.

When the generator circuit breaker opens on large modern central-station units under full load the flow through servomotor branch circuit 9-10-3 must

jump from zero to over 500 gal per min to effect sufficiently fast steam cut-off and thus prevent tripping the 110% emergency governor setting.

In Fig. 5, flow in general circuit 1-2-3-4(or 8)-5-6 remains substantially constant at all times, including transient periods of rapid governor action. Oil flow through main shaft-mounted pump may increase to over three times normal value to meet momentary servomotor demands. This peak flow occurs only in circuit 3-9-10 and therefore the passages in pump and servomotor, adjacent to one another inside the bearing housing, are made correspondingly large. Suction line 2 and feeding lines 4 and 8 are small since only the small bearing flow passes through them.

This improved arrangement is outstanding in economy of oil continuously pumped. No portion of the main-shaft-pump flow is continuously extracted for positive priming of the suction, and no excess oil is continuously pumped in preparation for rapid governing action.

Further reduction in main-shaft-pump size has been realized by appropriate use of a 2:1 area servomotor, which provides full-area force when moving in a direction to open the inlet steam valves, at which time the lifting forces are greatest and speed of opening of no consequence. Conversely, only a fraction of the available force in the 2:1 servomotor is needed in the direction of valve closing, but fast servomotor speeds are obtainable with only half oil-capacity demand on the pump.

In Fig. 6, showing self-regulating characteristics of the centrifugal pump, note that pump power consumption is at minimum during all normal steady-state conditions, and only during momentary demands is maximum power needed.

The pressure system starts by opening the standby-pump steam line through oil-pressure regulator 11, Fig. 5. Standby-pump oil flow closes the check valve in the main-shaft pump discharge. About normal oil flow passes through oil-wheel circuit 4-5-6 and through needle valve 8. Booster spins at full speed, filling suction line 1-2-3, establishing shaft-pump suction pressure.

Then starting the turbine-generator, as the main-shaft pump approaches normal speed its discharge pressure builds up to the pressure on the outside of the closed check valve. At normal speed, check valve opens and automatically starts flow through booster circuit 1-2-3 and standby pump gradually backs down to standstill. Standby pump may be motor- or steam-driven, in either case starting automatically with reduction in oil pressure.

Construction. In booster unit, Fig. 7, a short, rugged shaft mounted on two sleeve bearings carries the driving oil wheel on upper end and the booster impeller on lower end. Oil at 200 psig from the shaft pump enters nozzle casing P_4, and is directed tangentially through the oil wheel by a series of nozzles. Oil pressure reduces to about 40 psig in the nozzles and passes through the oil wheel to P_5 and into the oil cooler. The booster, submerged in lubricating oil, pumps from the reservoir through the inlet, into main-shaft suction line P_2.

The main-shaft-pump single-stage impeller, Fig. 8, mounts directly on the prime-mover shaft adjacent to thrust and journal bearings. All 200-psig-oil leakage past the sealing rings returns directly to the pump suction, avoiding needless burden on the booster. The entire pump casing is inclosed in the No. 1 bearing housing with servomotor and pressure-oil piping, thus providing maximum protection against accidental spraying of oil on high-temperature parts.

Summary. Features of this oil-pumping system are:

(1) Reduced power consumption of shaft centrifugal pump.

(2) Continuous quantity of oil pumped, decreased to that needed only by the bearing, with no excess for rapid governing or for positive priming of the pump suction.

(3) Smaller oil-pipe sizes from tank to main-shaft pump.

(4) Lower circulation rates allowing greater settling time for the oil.

(5) Adjustable suction pressure on the shaft pump, 10- to 30-psi positive pressure.

(6) Powerful double-acting 2-diameter servomotor realizing very rapid closing of inlet-steam valves with only half the capacity demands of the usual operating piston.

(7) Mechanical simplicity, absence of gears, couplings, shafting and bearings.

(8) Freedom in locating oil reservoir anywhere, down to 35 ft below turbine operating-room floor level.

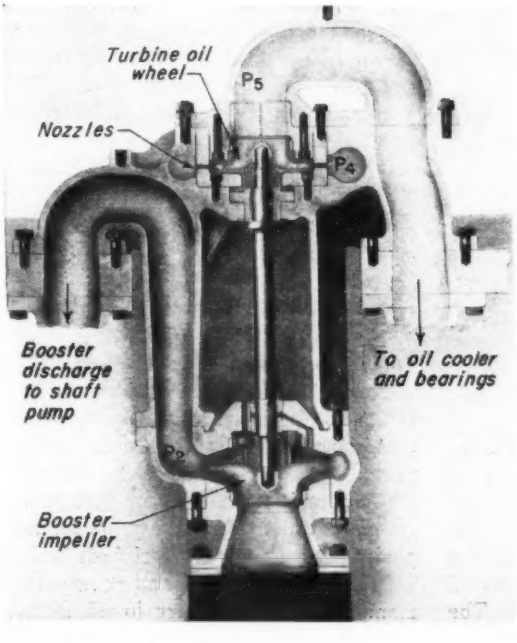


Fig. 7, left — An oil hydraulic-wheel, top, drives booster impeller, bottom, through a vertical shaft. Pressure of oil drops from 200 to 40 psig, in passing through the wheel on way to turbine bearings

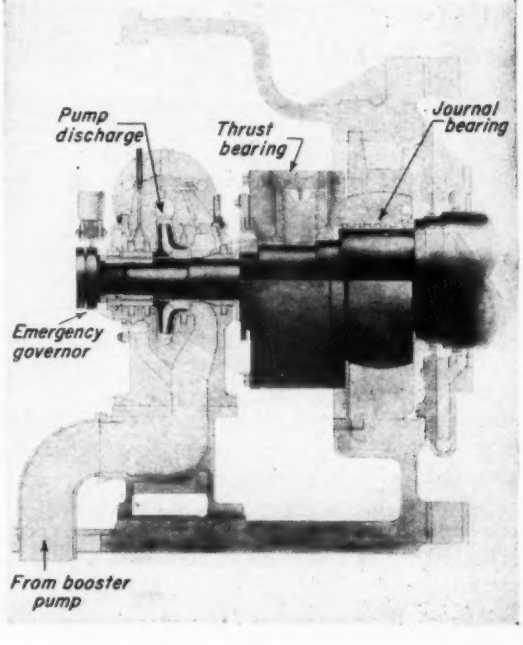


Fig. 8, right— Shaft-mounted oil pump is located between the emergency governor and thrust bearing of main turbine. Entire assembly housed in to avoid oil spraying on high-temperature turbine piping

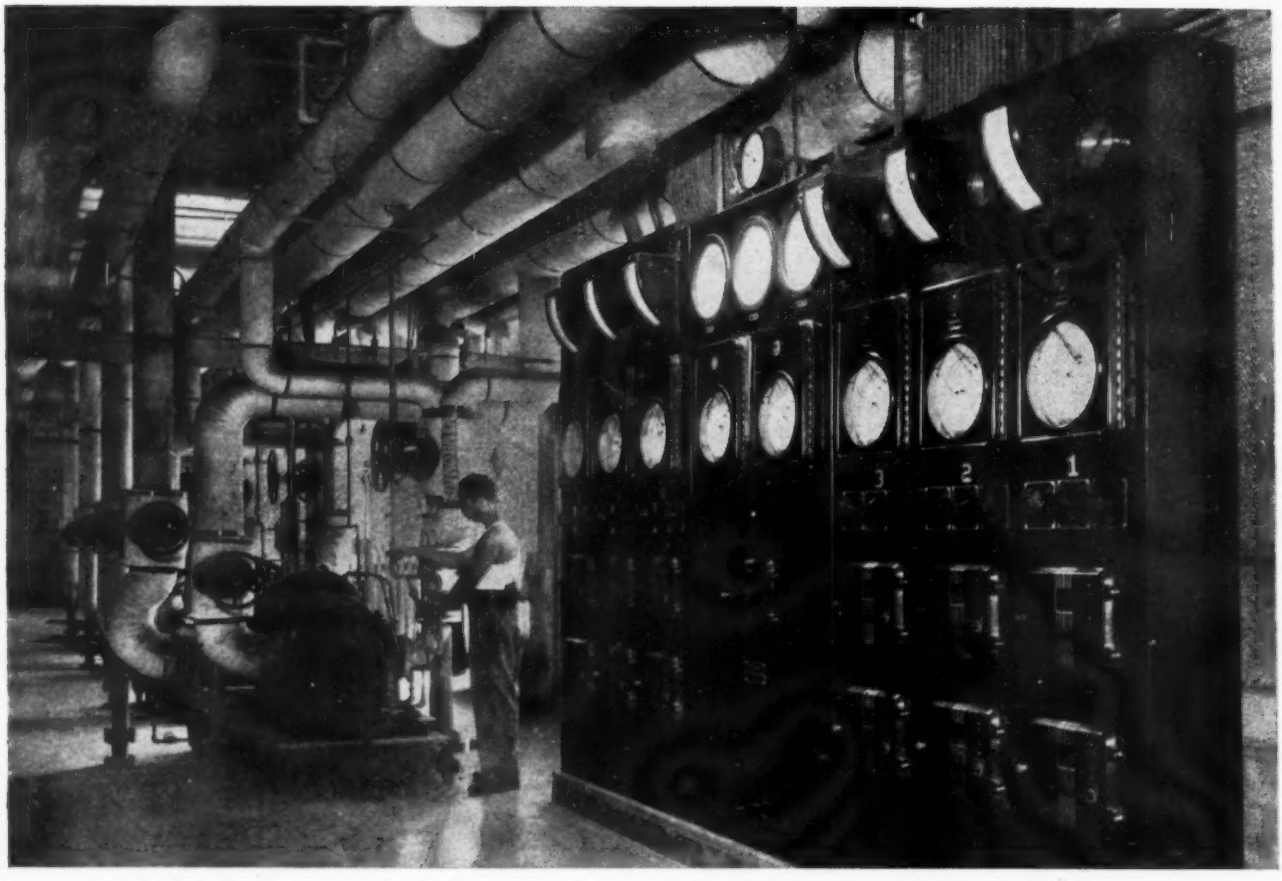


Fig. 1—Combustion control varies burner-oil pressure and draft-fan speed to maintain constant boiler steam pressure

Hot Lime Soda and Internal Treatment Condition 100% Feedwater Makeup

In this once-through pressure-reducing plant turbine exhaust, both steam and condensate, go to process. If steam demand exceeds exhaust supply, desuperheating stations take up slack

By V H BROGDON, *Superintendent of Power Plant, Nicaro Nickel Co*

▶ AMONG THE MANY wartime technological achievements is the nickel industry in Cuba, a new and important source of this essential metal. There, in 1943, the U. S. Government, through its agency, Office of Defense Plants, constructed a $33,000,000 plant. The Nicaro Nickel Co, a subsidiary of the Freeport Sulphur Co, which developed the new refining process used, operates the plant under a contract with Office of Metals Reserve, another U. S. Government agency.

Servicing this new industry is a modern power plant, the second largest in Cuba, with an installed generating capacity of 17,300 kva. It is on the island's northeast coast, in Oriente Province, almost due south of New York City.

Before the development of this project, the Western Hemisphere depended upon Canada for practically all its nickel. Large deposits of lateritic-type ores containing from 1 to 1.5% nickel were known to exist in Cuba, but the low content could not be extracted economically by proved processes. The Government wartime program of developing new sources of raw materials found the Freeport Sulphur Co working privately on a new process, which was sufficiently far advanced for economical extraction of nickel from these low-grade ores to seem probable. After a careful study of pilot-plant tests and data by a group of prominent engineers selected by Reconstruction Finance Corp, the project was approved and the Nicaro Nickel Co, acting as agents for Office of Defense Plants, started design and construction of the plant, Fig. 2.

Power-Plant Capacity. Preliminary estimates of power and process-steam requirements were made, and orders placed immediately for boilers, turbines and equipment to keep pace with process-plant construction. Equipment capacity was based on estimates of a 7500-kw electrical load and process demand of 110,000 lb per hr of 10-psi

steam. A large factor of safety incorporated in the boiler-plant design proved of great value because the process flowsheet was revised during construction. This raised the process-steam demand to 220,000 lb per hr, and the estimated electrical demand to 10.000 kw, which necessitated adding another generating unit.

Notwithstanding the design changes, equipment substitution, poor deliveries, and construction problems in the isolated location, the first generator was placed on the line permanently Sept 20, 1943, only about 20 months after conception of the project. Reason for this speed was that basic policy during design and construction permitted no changes except those essential to maintain satisfactory power-plant service. Consequently, initial operation was somewhat more difficult and inefficient than it would be in a plant designed under normal conditions. During two years' operation many problems have been solved, and economy studies indicate that plant efficiency can be increased 2 or 3%.

Boiler Design. Steam is generated at 225 psi and 515 F in six Babcock & Wilcox 9320-sq-ft Stirling boilers. Bunker-C oil is fired in B & W steam-mechanical burners. Heat release is 16,000 Btu per cu ft of furnace volume at normal loads, or 200% rating. Combustion air cools the furnace walls.

Low-pressure boilers were selected primarily for three reasons:

1. Heat-balance studies indicated that, with a large percentage of steam extracted at 10 psi for process, little improvement in plant economy could normally be secured with higher efficiency in the steam cycle.

2. Boilers operate on 100% raw-water makeup, treated hot with lime and soda ash; any condensate from turbine exhaust goes to process.

3. Wartime conditions indicated the need for simplicity, not only because there were material shortages, but also because the plant would have to be placed in service with comparatively inexperienced operators.

Each boiler has its own variable-speed turbine-driven induced-draft fan. Three concrete stacks are provided, into each of which two boilers discharge. Leeds & Northrup and Bailey Meter combustion-control systems automatically vary burner oil pressure and draft-fan speed to maintain a constant steam pressure on the header and proper furnace draft, Fig. 1. Each boiler has Copes feedwater control and Diamond Power Specialty soot blowers. High- and low-water alarms are provided on the gage columns.

Generating Equipment. Primary power-generating equipment, Fig. 3, consists of six 2050-kva 2300-v 60-cycle 3-phase 3600-rpm Crocker-Wheeler Electric generators, direct-connected to Worthington Moore turbines. Four turbines are condensing-extraction units, and two operate on backpressure.

Condensers are shell and tube, using 2-stage steam-jet air ejectors. Each contains 2220 sq ft of condensing surface in 892 arsenical-aluminum brass tubes, ¾ in. in diameter and 12 ft in length, to pass 3500 gpm of seawater.

The four condensing turbine generators were originally designed and built for a Ford Motor assembly plant, but were transferred to the Nicaro project because of the need for rushing nickel production. The two backpressure units were designed specifically for Nicaro.

A seventh turbine-generator (General Electric) was purchased second-hand from the American Woolen Mills. Originally a 3000-kw 2400-rpm 600-v 2-phase 40-cycle unit, the turbine was rebuilt and the generator rewound for a capacity of 6000 kva before shipping it to Cuba. The turbine can operate either full condensing or extracting at 10 psi for process. Condenser is a Westinghouse Electric jet unit, having a small turbine driving both the air pump and discharge-water pump from the same shaft. This generating unit serves primarily as a standby for emergency service because it has a high steam rate at low loads, and only a small percentage of steam can be extracted at higher, more efficient load.

Boiler steam goes to the main turbines, auxiliaries, a 100-psi and 10-psi reducing and desuperheating station, Fig. 4. Economy of plant operation depends principally upon the ratio of required 10-psi process steam and the

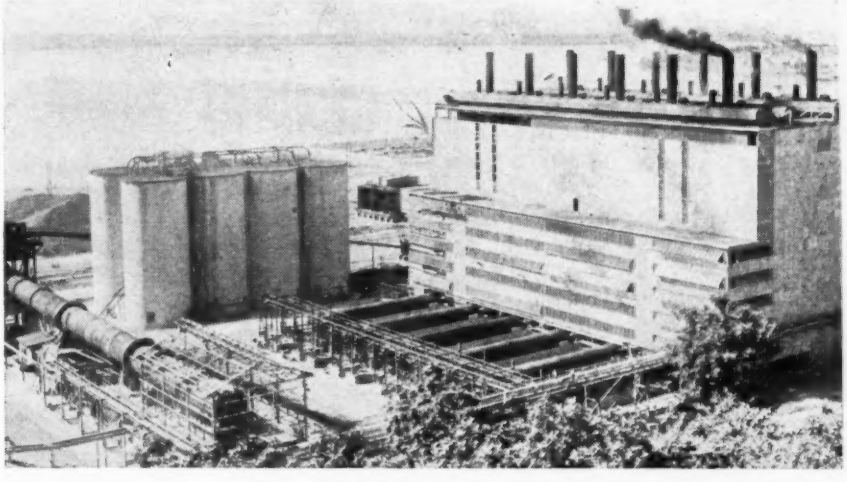


Fig. 2—Metallurgical plant produces more than twenty-five million pounds of nickel in a year in sixteen of the largest Herreshoff furnaces in the world

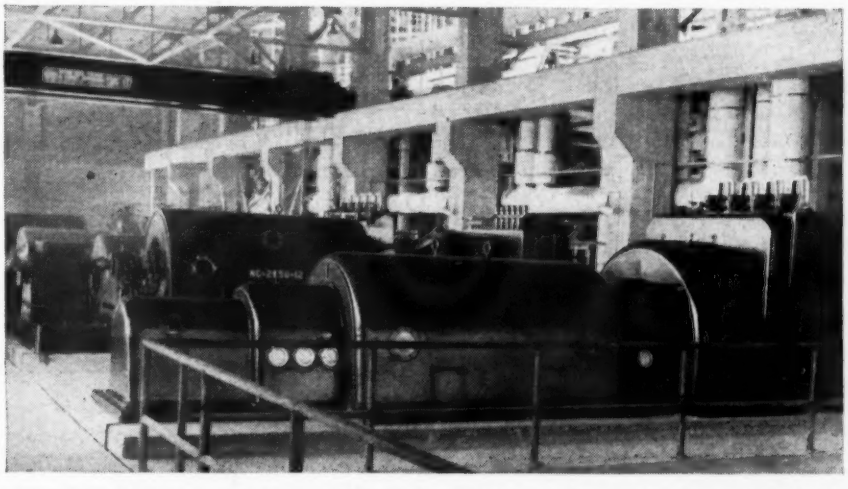


Fig. 3—Electrical-generating equipment consists of five condensing and extraction turbine-generators and two that operate against exhaust backpressure

electrical load. Depending upon this ratio, plant operation falls into two distinct categories:

1. Process requires more 10-psi steam than can be supplied by the main turbines and plant auxiliaries. The additional amount is secured by reducing high-pressure steam to 10 psi through a desuperheating station, and plant economy is effected by maintaining a minimum flow of steam to the condensers. This requirement in turn may be subdivided into conditions where:

a. Power needs are low, allowing the condensing turbines to operate in the range of practically 100% extraction. Steam going to the condensers is only that which bypasses the bleeder-stage valves to cool the condensing section of the turbine.

b. Power needs are high and turbines must operate practically condensing to put out the required energy. Maximum extraction of steam at the operating load is necessary for economical operation of the power plant.

2. Process requirements are less than the maximum that can be supplied by the turbines, and they must operate condensing. Under this condition process-steam pressure is held constant by the turbine governor, which regulates the amount of steam going to the condenser.

With the turbine-bleeder governor adjusted correctly, efficient operation is secured automatically and little is left to the operators' judgment.

Feedwater Treatment. Water-treating equipment, designed by Graver Tank & Mfg Co, uses a hot lime-soda system consisting of two vertical 34,000-gal treating tanks, six vertical filters, necessary chemical tanks, proportioners, etc.

Water, entering the treating tank through a spray at the top is preheated by steam leaving the deaerating section. It then passes downward through a 4-ft-diameter mixing and reacting compartment, which extends almost to the bottom of the tank. In this section the incoming water, aided by a mechanical agitator, mixes with lime, soda ash and copperas. Flow leaving the reaction section passes upward through a sludge blanket and overflows into a deaerating chamber. Here the water is heated to 230 F by coming into intimate contact with 10-psi exhaust steam entering under the water surface through numerous small orifices.

Chemical proportioners are actuated from integrators on the meters that measure total flow to the tank. Every 250 gal, the integrator makes contact to actuate an electric timer, regulating the operating period of a small motor that lowers the skimmer pipe through which chemical leaves the tank. Treatment is thus varied by changing the proportioner-timer setting, allowing the lowering motor to run a longer or shorter time at each impulse from the meter integrator.

Water leaving the treatment tanks is filtered through six 8-ft-diameter vertical filters containing anthracite coal as the filtering medium. At maximum operating loads these units have a filtering rate of 0.5 gpm per sq ft.

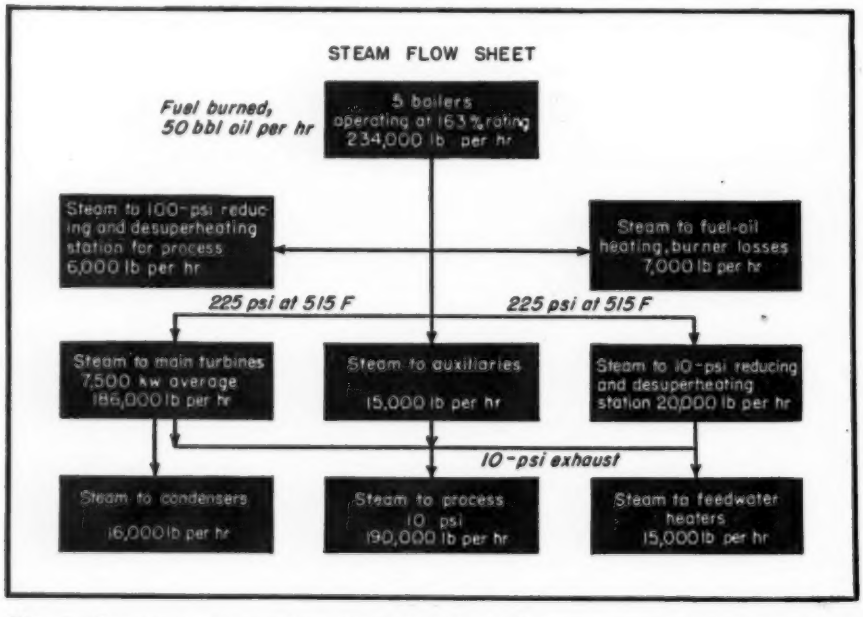

STEAM FLOW SHEET
Fuel burned, 50 bbl oil per hr
5 boilers operating at 163% rating 234,000 lb per hr
Steam to 100-psi reducing and desuperheating station for process 6,000 lb per hr
Steam to fuel-oil heating, burner losses 7,000 lb per hr
225 psi at 515 F
225 psi at 515 F
Steam to main turbines 7,500 kw average 186,000 lb per hr
Steam to auxiliaries 15,000 lb per hr
Steam to 10-psi reducing and desuperheating station 20,000 lb per hr
10-psi exhaust
Steam to condensers 16,000 lb per hr
Steam to process 10 psi 190,000 lb per hr
Steam to feedwater heaters 15,000 lb per hr

Fig. 4—Economy of operation depends principally upon the ratio of required 10-psi steam and the electrical load, 100-psi station serves independent load

Filtered, treated water at 230 F goes to the boiler feed pumps with a positive pressure of 18 psi at the pump suction. Pumps are 2-stage centrifugal units equipped with governors that maintain an excess feedwater pressure of 50 psi. Boilers are treated internally with disodium phosphate, and sodium sulphite is added at feed-pump suction.

Boiler-water hardness, before treatment, is principally magnesium with some silica. Typical analyses before and after treatment follow:

Impurities	*Untreated ppm*	*Treated ppm*
SiO_2	6.0	3.2
R_2O_3	2.0	0.9
Ca^{++}	0.4	3.8
Mg^{+}	20.8	0.5
SO_4^{--}	1.9	2.9
Cl^{-}	17.0	13.8
OH^{-}	0.0	4.1
CO_3^{--}	2.7	16.5
HCO_3^{-}	94.0	0.0

Water treatment is controlled by hourly titration of samples with acid to phenolphthalein and methyl-orange endpoints. Variation in titrations are caused by changes in excess OH^- and CO_3^{--}, and lime or soda-ash feed is increased or decreased to maintain the excess OH^- and CO_3^{--} desired. Disodium phosphate is fed internally to maintain an excess of 20 ppm of PO_4 in the boiler blowoff.

Operating Experience. Continuous blowdown is regulated to maintain total solids in the boilers at 1500 ppm. Once daily, the mud drum is blown down by hand to remove accumulated sludge. Boiler tubes, turbined after six months' operation, show negligible scale deposits, and only soft phosphate deposits are found in the feed drum. No indications of foaming or priming have been encountered.

Serious corrosion of the original Admiralty metal condenser tubes was encountered shortly after initial operation. The failures were attributed to the selection of the wrong type of metal, aggravated by turbulence, which was caused by partial tube stoppages with foreign material and marine growths. A change to arsenical-aluminum brass with ASTM specifications of Bill-42 has apparently eliminated this trouble.

Circulating-water pumps with cast-iron casings have also corroded seriously, and will need to be replaced after about four years' service handling sea water. This type of corrosion leaves the graphite of the cast iron intact while dissolving the iron of the casings.

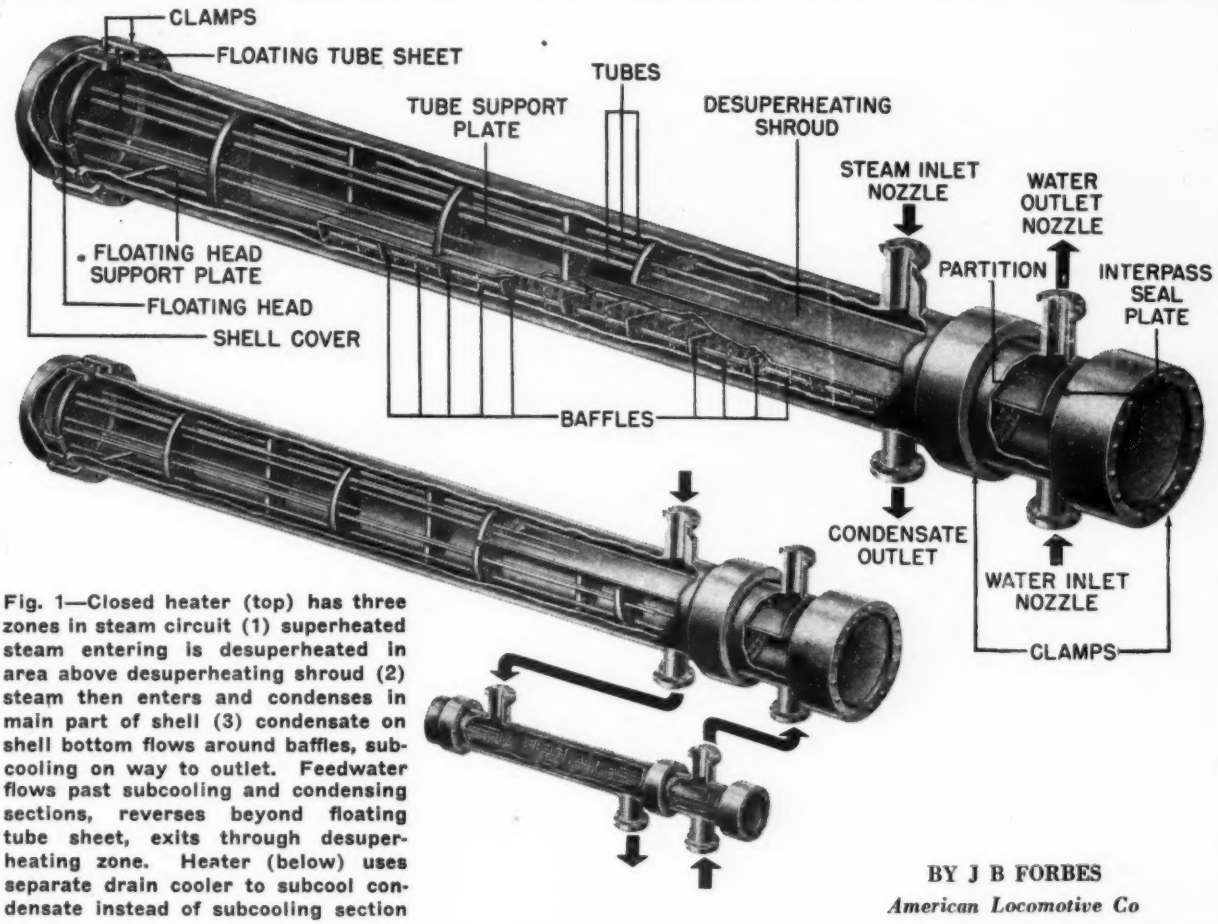


Fig. 1—Closed heater (top) has three zones in steam circuit (1) superheated steam entering is desuperheated in area above desuperheating shroud (2) steam then enters and condenses in main part of shell (3) condensate on shell bottom flows around baffles, subcooling on way to outlet. Feedwater flows past subcooling and condensing sections, reverses beyond floating tube sheet, exits through desuperheating zone. Heater (below) uses separate drain cooler to subcool condensate instead of subcooling section

BY J B FORBES
American Locomotive Co

Feedwater Heaters Vary in Arrangement

Design of feedwater heaters depends on steam and water pressures to be handled and on plant physical layout. Some closed heaters of recent design (1) heat feed above steam saturation temperature when steam's superheated (2) subcool heating-steam condensate with inlet feedwater as well as (3) condense the steam that does most of feedwater heating

▶ CLOSED FEEDWATER HEATERS raise boiler-feedwater temperature, using steam as the heating medium. This heater type must be employed when water and steam pressures are different and circumstances require that these pressure differentials be maintained. Most frequent application of these heaters is in the regenerative cycle where bleed steam from one or more turbine stages acts as the heating medium. This arrangement, which allows great design flexibility, provides a means of striking an economic balance between operating and investment costs.

With relatively low boiler-operating pressure only one feedwater heater, or one stage of heating, is usually needed. But in modern central-station practice, with relatively high boiler pressures, three to four feedwater heating stages are usually applied to raise water temperature to the desired value. This is done by running the boiler feedwater through the tubes of the various heater stages in series flow, the first- and second-stage heaters being located on the boiler feed-pump suction side, and the third- and fourth-stage heaters on the boiler feed-pump discharge side.

This arrangement permits low-pressure construction for the heaters before the feed pump, while the final-stage heaters have to be designed for the boiler feed-pump shutoff pressure. Low-pressure heater construction employs conventional shell-and-tube heat exchangers with separate waterbox and separate removable tube bundle. With low pressures and medium temperatures Admiralty or copper tubing and nonferrous tube sheets can be used.

For the high-pressure stage heaters, usual practice employs a combination waterbox and stationary tube-sheet construction made from forged steel, thereby eliminating one high-pressure gasketed joint. With this arrangement

the waterbox and tube bundle are removable as a unit. There have been instances where the plant-design engineers felt that it was desirable to build the heaters so the high-pressure water connections would be permanently welded to the station piping. Instead of removing the bundle from the shell the units have been designed for shell removal, leaving the tube bundle in place in the piping system. This rather unusual situation requires ingenuity on the part of the heater designer to insure that the tube bundle will not sag unduly when the shell is removed.

The combination of high pressures and temperatures usually dictates the use of nonferrous-alloy tube such as cupro-nickel or monel to permit using a reasonable tube-wall thickness, and thus minimize pressure drop.

Each individual heater stage raises the water temperature to within three to five degrees of the saturated-steam temperature. It is sometimes economical to condense the vapor from the evaporator system in one of the feedwater heaters. Usual practice cascades the condensate from higher-stage heaters to the shell of the next lower-stage heater, thereby partially flashing it and using the heat of this flash steam to reduce the amount of bleed needed in this stage heater.

USING SUPERHEATED STEAM

Sometimes sufficient superheat exists in the heating steam, and economics warrant additional investment in heating surface to permit raising the boiler feedwater temperature several degrees above heating-steam saturated temperature. To do this the feedwater heater must be equipped with a suitably baffled desuperheat zone, separate and distinct from the heater main-condensing surface. This zone in the heater of Fig. 1 is bounded by the desuperheating shroud, heater shell, and waterbox tube sheet. Superheated heating steam enters the zone through the inlet nozzle, and flows parallel to the tubes leaving through the holes in the support plate to enter the main condensing-shell volume. The desuperheating zone is the last region through which the feedwater flowing in the tubes passes before entering the outlet waterbox.

Sometimes it is economical to incorporate in a heater a suitably baffled drain-cooling section in which the heating-steam condensate flows in close contact to the tube surface, separate and distinct from the condensing surface. Here the condensate subcools several degrees below saturation temperature, Fig. 1. Condensate collects in the lower part of the shell, where the baffles cause it to flow crosswise, back and forth, over the tubes on its way to the outlet. Feedwater flowing through the tubes first passes through this subcooling zone before entering the main condensing surface.

In some instances, such as Fig. 1, a single heater has all three features: desuperheating zone, condensing zone and subcooling zone. In designing such heaters extreme care must be exercised in setting up these zones to minimize the tube stresses because of the wide range of temperatures involved in the one unit. If proper care is taken, floating-head construction can be employed on such a unit. Sometimes, however, the temperatures involved impose such differential stresses in the tubes as to warrant U-tube construction, Fig. 3.

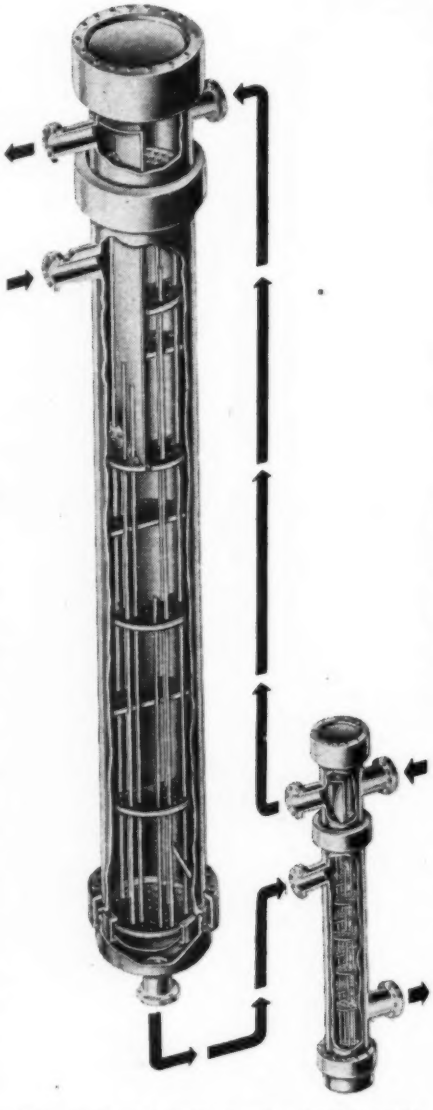


Fig. 2—Vertical feedwater heater with desuperheating section uses separate drain cooler for subcooling the heating steam condensate from heater. Condensate collects on floating tube sheet, spills over clamp ring into shell cover acting as heater hotwell

One of the most important considerations in designing closed feedwater heaters is locating the shell vent connections. Usually one or more sections of the tube bundle are baffled to insure complete condensation of all steam and subcooling of all noncondensable vapors before removal from the shell. No hard and fast rules in locating the air-baffle sections can be made as this must be determined for each installation, depending on the type of heater—whether vertical or horizontal—the location of the steam inlet, and the operating conditions under which the heater works.

In vertical heaters waterboxes are usually located at the top to utilize the shell cover as a hotwell for collecting heating-steam condensate, Fig. 2. Any desired subcooling must then be done in a separate drain cooler. On horizontal heaters usual practice provides a cylindrical hotwell as an appendage at the shell's lower side.

CONSTRUCTION REQUIREMENTS

All feedwater heaters should be constructed in strict accordance with the *Unfired Pressure Vessel Code*, of the ASME. All gasketed joints should be full tongue and groove construction and securely held by a recognized bolting closure. To meet the exacting requirements of modern high-pressure heater construction a clamp-ring type closure has been developed which securely holds gasketed joints in leakproof contact on water pressures up to and including 2500 psi. This construction is shown in section on the shell cover in Fig. 1.

To realize the greatest ease in maintenance, feedwater heaters should be designed so the completely assembled tube bundle can be removed from the shell without dismantling the shell-cover joint and without breaking piping connections to the shell. It is also recommended that equipment for this service be supplied with a separate cover on the waterbox to permit examination of tubes without disturbing water piping connected to the heater.

Because of the conditions under which a closed-type feedwater heater operates with boiler feedwater in the tubes and uncontaminated steam in the shell, there is very little fouling of the tubes, and therefore maintenance and cleaning on this type equipment is negligible. With straight-tube floating-head construction, however, it is a simple mat-

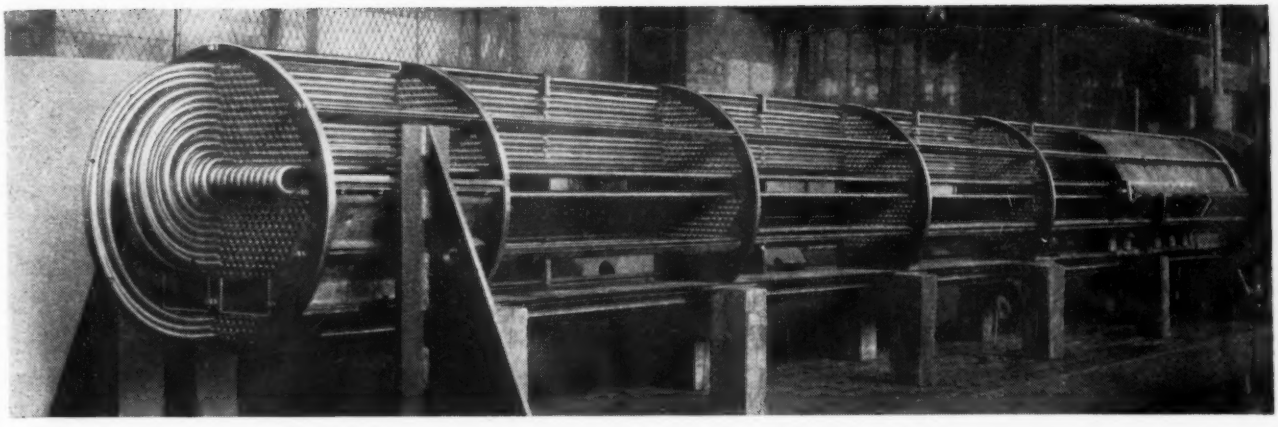


Fig. 3—Horizontal feedwater-heater tube bundle, partly assembled, utilizing U-tubes instead of reversing chamber beyond floating tube sheet (at near end), note baffle arrangement to induce steam cross-flow around tubes

ter to examine the tube interiors periodically to determine the necessity for cleaning. This examination can be made by simply removing the waterbox cover, the shell cover and floating-head cover to expose the inside of the water tubes.

In a horizontal heater this inspection precludes the necessity of disturbing any piping connections, and in vertical heaters it is only necessary to break the condensate piping before examining.

A properly designed piece of equipment in this service should operate ten or more years without repairs or replacements. Beyond the 10-year period the only repairs and replacements that should be necessary would concern a small percentage of all the tubes.

Heat Pump Saves Coal in British Power Plant

▶ How the engineers of the Norwich (England) Electricity Dept built a heat pump from scrap parts and with it saved 40% of the coal formerly used to heat the power-station building was described in a BBC broadcast by John A Sumner, City Electrical Engineer.

After outlining the principle of the heat pump, familiar to most power engineers, Sumner told how the Norwich unit was built. With war shortages to contend with, engineers assembled the required material in devious ways, mostly from scrap material lying about the plant. The evaporator, containing sulphur dioxide which boils at 30 F at 22 psia, consists of three 14-in. cast-iron water pipes, each 14 ft long. Ninety-eight ¾-in. condenser tubes are carried inside each pipe, forming a shell-and-tube construction. The compressor is, at present, a second-hand refrigeration unit taking about 80 hp.

When the plant is running, river water passing through the condenser tubes causes the liquid sulphur dioxide to evaporate to a gas, extracting the latent heat from the water, which returns to the river several degrees cooler. The sulphur dioxide containing the heat thus abstracted from the river is compressed until its temperature is lifted from about 40 to 200 F. This heated gas passes into a unit similar in construction to the evaporator, in which the water for heating the building circulates. The gas gives up its heat to the water and condenses. It then flows through an expansion valve into the evaporator and the cycle repeats.

What are the practical results of using the heat pump? In a normal winter season, 192 tons of high-grade coal were used to heat the building. With the heat pump, the job was done with 189,000 kwhr of electricity, which required only 105 tons of low-grade coal for its generation. This represents a saving of 87 tons of coal, or about 40%, an extremely worthwhile gain when coal is scarce and expensive.

Sumner went on to discuss the general applicability of the heat pump, pointing out that there are limitations to the use of large units. Not every building is situated close to a river, as is the plant at Norwich. There are two possible ways of dealing with this limitation: (1) Install the plant at river side and transmit heat to the buildings to be warmed through a piping system. This form of district heating is being considered at Norwich. (2) Heat may be extracted from the air instead of from water, but a good deal of experimental work will have to be done before air can be used as a low-grade heat source.

The ideal economic case for using a heat pump is one where heat and cold are required simultaneously, for example, in a building containing an ice-skating rink in one part and a swimming pool in another.

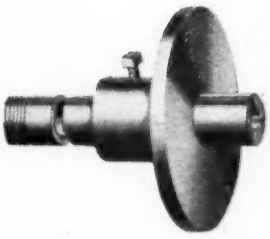
In conclusion, the speaker expressed belief in the future of the heat pump, citing as his reasons its adaptability for either heating or cooling, and the possibilities in applications where heating and cooling are required simultaneously, the ideal condition.

CORRECTION

On the typical blowdown control chart appearing on p 108 of *Steam Generation*, special section, POWER, Dec 1946, the lines "total evaporation 1000 pounds per hr" are not needed for determining percent blowdown, and should not be used in this case.

SOOT REMOVAL: An Operating Must

In a series on removal of soot deposits formed by firing of most fuels, Assistant Editor McCabe here discusses soot-removal devices, including dual-purpose attachments. Later articles will progress from fixed-position soot blowers to units using high mass-flow principles and retractable elements



1 Simple metal disk of the clean-out plug type moves under pressure of steam or air through tubes of a fire-tube boiler to dislodge soot

► EFFICIENT TRANSFER of heat in boiler or steam generator depends upon clean surfaces on both fireside and waterside. Soot, flyash, cinder and slag, the fireside deposits formed from firing most fuels, constitute an insulating barrier between available heat released in the furnace and that transferred to water in the tubes.

Development of these heat-wasting deposits comes about as follows: Soot, nearly pure carbon in composition, results from a cooling in the combustion process. This cooling, actually a chilling below the ignition point, settles out unburned volatile matter to form a substance like lampblack. Its nature depends on whether the fuel is oil or coal. In general soot is soft, fluffy, somewhat tarry. With oil it tends to be more tarry because of the heavy hydrocarbon content. This tarry character permits it to encompass the full tube, thus increasing the surface area insulated from available heat.

Flyash, a dry, powderlike substance, occurs in pulverized-coal installations. It consists of fine, gray, sharp-edged pieces, almost entirely ash in composition. These undesirable byproducts sweep along with the flue gas to settle out on furnace surfaces or be discharged from the stack.

Cinder, a combustible made up of ash and unburned carbon, has a lavalike appearance under the microscope. It indicates more than exposure to flame; it shows evidence of partly completed combustion. It is usually sandy, dry, black, and—in unbroken pieces—has a spherelike shape. Often, in their travel through a furnace, these spheres are fractured, and jagged fragments develop.

Slag, actually ash, has once been in a molten state under furnace heat. Cold-tube surfaces, however, have solidified it, and it is left clinging to these surfaces in chunks or as a heavy mass.

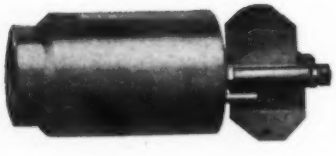
Some idea of the toll exacted by unwanted deposits on fireside surfaces can be had from studies over a period of years by the U. S. Bureau of Mines. These studies describe soot, for instance, as a heat insulator five times as effective as a similar thickness of asbestos. • Another widely circulated operating guide states that, for every 25- to 30-deg-F reduction in stack temperature, a saving of 1% in fuel results.

HAND TUBE CLEANERS

Hand lances, employing compressed air or steam, are used on installations not equipped with soot blowers, or where soot or ash deposit forms in an area not reached by soot blowers. Flexible piping or hose delivers steam or air under pressure to a discharge nozzle or opening. From this discharge point the air or steam is directed along the surface to be cleaned.

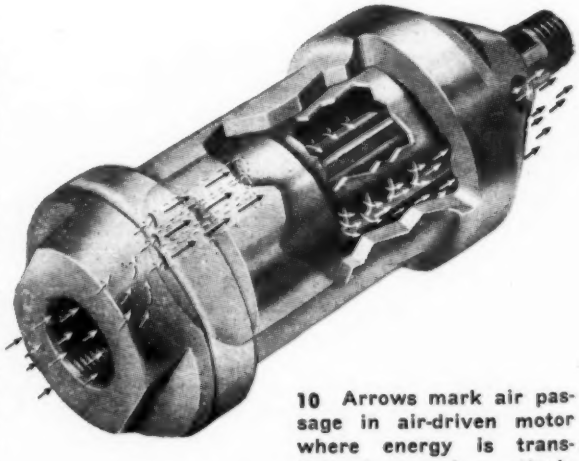
This class of tube cleaner finds its widest application in surface cleaning performed during shutdown. Occa-

7 A drill-head assembly. Its chain-type joints are of square stock with corners that are rounded to give broad hinge surface



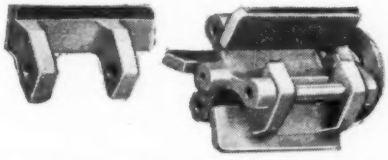
8 A power-driven soot scraper that operates from steam or air at 40 to 45 psi. In operation centrifugal force whirls blades out to vertical position

9 A water-driven, turbine motor with bronze turbine wheel at the forward end. Usual operation is 125 psi, but motor is built for 75 to 250 psi



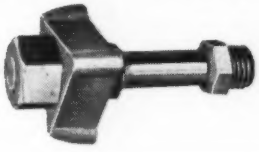
10 Arrows mark air passage in air-driven motor where energy is transformed to give attachments mechanical drive

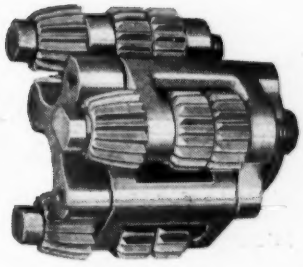
2 Hose coupling before assembly depicts rugged structure needed for cleaner service. Hose made of fabric plies has reinforcing of oval wire winding that opposes any twist caused by rotation



3 Expanding scraper-head fitting removes soot

4 Replaceable 3-part drill head. 5 A vibrating head gives a tube-tapping action





6 A swing-frame head for curved tubes has individual cutters spread apart from a central and supporting spider

sionally a clean-out plug or disk (page 110, June 1946 POWER) is shot through a tube under the impulse of the steam or compressed-air pressure. This plug dislodges soot or scale in a fashion similar to "shooting a condenser", Fig. 1.

A more intensive system employs a flexible pipe, hollow shaft, or specially adapted hose, Fig. 2, with coupling fixtures that permit the attachment of various brushes, vibrating heads or drills (Fig. 3, 4, 5, 6). These devices, in turn, usually employ power drives, such as air, steam or water-driven motors, Fig. 8. They operate on pressures from 40 to 125 psi under air, or from 40 to 250 psi with water or steam. Fig. 9, shows a water-driven motor assembly and 10, a similar, air-driven assembly. An operating air valve, such as Fig. 13, permits one-man operation of the completely coupled assembly, Fig. 11.

Cleaner Attachments. Operation of these hand or portable systems comprises feeding the assembly through the individual tubes. The particular job and its effectiveness depend in part upon the class of attachment, drill, brush, etc, and the nature of deposit—scale, soot, etc.

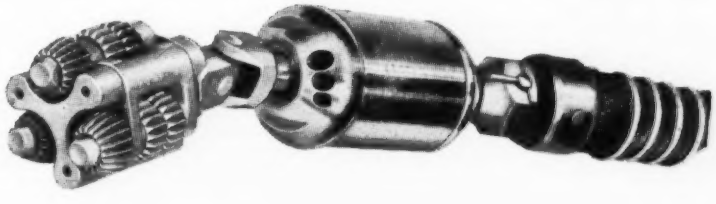
The vibrating head, Fig. 5, taps the inside of the tube (usually a fire-tube boiler where soot deposit has already been brushed or blown out) and dislodges scale accumulations on the waterside, as well as loosening any on the fireside. Power drive for such service can be from steam or compressed air, but water-driven power units are not recommended for firetube installations.

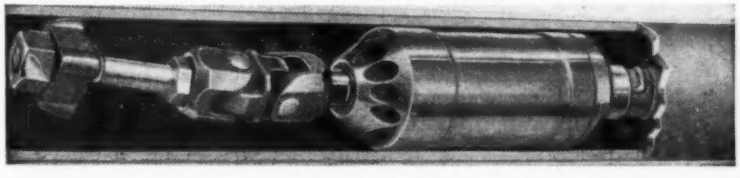
Majority of other hose attachments, such as drills and brushes, may be used for both watertube and firetube cleaning. Many adaptations permitting effective scale removal of curved surfaces appear in the wide variety of fittings on the market. Different head designs provide scraping and cutting as well as tapping mentioned above.

Types of Drive. In all such cases the power medium, steam, air or water, usually discharges down the tube length to carry with it all removed tube accumulations. Air in Fig. 10 enters the air-motor from the hose through a 3-port entrance plate. After passing through these openings the air is directed through ports against a solid fiber blade placed in a slotted steel shaft. Air discharges from the blade cylinder-housing into an exit passage.

Steam- and water-driven motors also supply power drive for these various fittings. Their operation comes, in one design, from a bronze turbine wheel at the forward end, Fig. 9. Spent water or steam empties into the open tube, reducing the motor's backpressure. An alloy-steel shaft and special steel bearings give good operating life. Operating pressure ranges from 40 to 250 psi but is usually placed by recommendation at 125 psi. Steam units are not preferred if enough air or water can be had to remove the deposits.

11 A completely connected cleaner assembly with a swing-frame head (Fig. 6), motor drive and air valve. The latter, Fig. 13, appears behind the motor with the handle in operating position as it appears within a tube





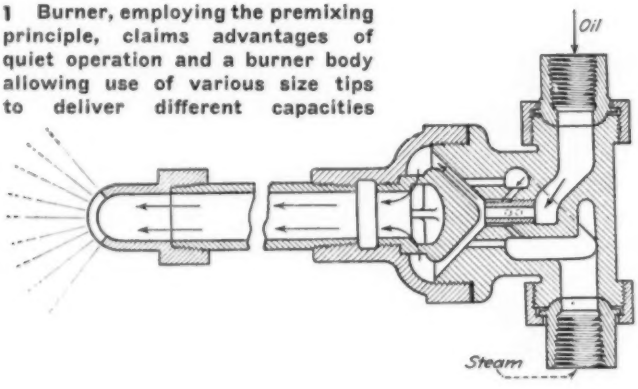
12 Vibrating-head attachment, Fig. 5, at work within a firetube. Behind the head come the universal connecting joints, Fig. 7, followed by the power drive

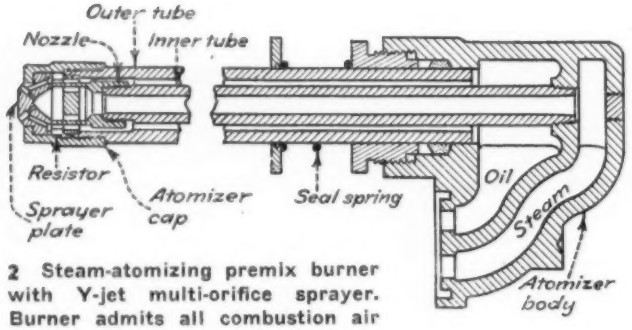
13 Air valve shows the on-off handle, which closes by making a 90-deg turn

TWENTY YEARS OF PROGRESS

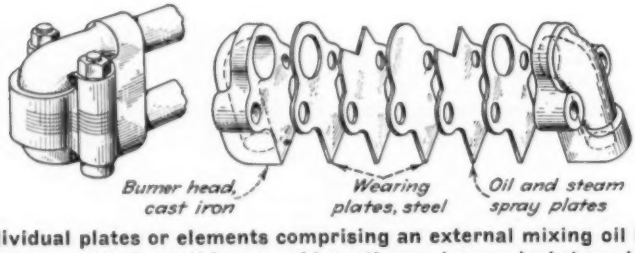
Rene J Bender, assistant to the chief consulting engineer, Sinclair Refining Co, describes three industrial oil-burner systems: steam- and mechanical-atomizing, and horizontal rotary-cup burners. Application and capacity are stressed*

1 Burner, employing the premixing principle, claims advantages of quiet operation and a burner body allowing use of various size tips to deliver different capacities

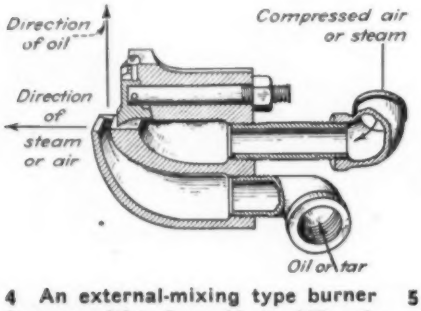




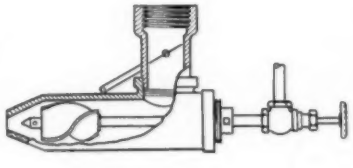
2 Steam-atomizing premix burner with Y-jet multi-orifice sprayer. Burner admits all combustion air



3 Individual plates or elements comprising an external mixing oil burner. Flat flame results from this assembly; others give conical-shaped flames



4 An external-mixing type burner for capacities from 1/8 to 166 gph



5 Compressed air serves as the atomizing medium for this burner

► REFINING OF CRUDE OIL underwent many changes from wartime development of aviation fuels. Nevertheless, production of residual fuel from crude represents from 15 to 30% of every barrel, a yearly average of 335 million barrels. This fuel supplies about 350,000 industrial oil burners, as well as those aboard U. S. Navy ships. Manufacture of these burners increased from 18,433 in 1936 to 33,077 in 1945.

Optimum oil-burner operation requires design provisions for (1) proper refractory, less porous than ordinary firebricks (2) ample furnace and tube proportions (3) selected metal quality of all accessories subject to damage from the action of certain components of the ash. Prime requisite for the burner itself is a correct flame shape and travel. If this requisite is met, impingement upon furnace walls or boiler tubes does not occur and unburned oil droplets, with their eventual tarry residue, cannot collect on tube surfaces. Oil-burner design in the past 20 years has so developed that proper burner selection for a given job is not a difficult assignment. Selection comes from steam-atomizing, mechanical-atomizing, and horizontal rotary-cup burners.

Steam-Atomizing Burners. This type burner was among the first used. Installation is inexpensive and fairly simple where no attempt is made at simultaneous control of steam and oil supply. They possess an ability to burn almost any fuel oil, of any viscosity, at any temperature. A popular application occurs in conversion jobs, such as low-setting hrt boilers, where flame shape should approximate that of the fuel bed. Steam consumption for oil atomizing runs from 1 to 5%; averages about 2%. Pressure of steam, varying from 75 to 150 psi, can be taken from a low-pressure line, a desuperheater with a pressure reducer, or a drum vent through an orifice and a regulating valve.

Steam-atomizing burner designs provide either a conical flame of almost any angle or a flat flame. These burners can be further divided into (1) premixing type—oil and steam mix inside the body or tip of the burner before being sprayed into the furnace, Fig. 1 and 2, or (2) external-mixing type—oil emerging from the burner is caught, prefer-

* *Abstracted from a paper presented before the ASME fall meeting, Boston, Mass., Sept. 30–Oct. 3, 1946.*

IN INDUSTRIAL OIL FIRING

ably at right angles, by the steam jet, Fig. 3 and 4.

Compressed air, another means of oil atomization, generally leads to excessive firing costs, which tend to limit its application. Oil pressure for such installations, Fig. 5, ranges from 15 to 25 psi; air pressure from 1 to 1½ psi.

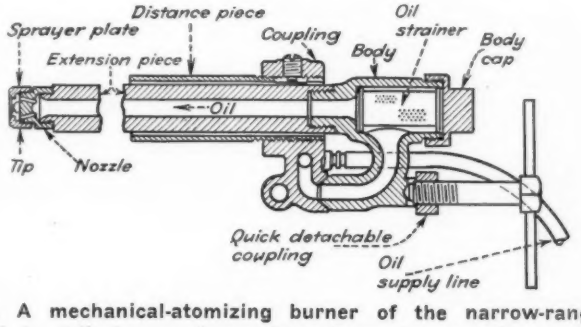
Mechanical Atomizing Burners. A good quality of atomizing results from releasing highly compressed fuel oil through a small orifice. Efficient combustion develops by admitting required air for burning at proper pressure and in the right manner into a cone of oil atomized as above. Best atomizing action, however, occurs at one capacity for a given orifice since this action depends upon the oil pressure producing it. By varying this oil pressure, a 40% capacity range can be achieved while maintaining a suitably good atomization. To permit following a fluctuating boiler-steam load with mechanical atomizing, certain compromises must be made: (1) A great number of burners may be installed to permit turning one or more on or off as steam demand varies. (2) Different-size burner tips can be adapted to each burner body.

For best results from mechanical atomizing, oil should be supplied to burners within a pressure swing of 225 to 300 psi and an optimum viscosity of 150 ssu. Proper control of oil temperature permits holding this viscosity.

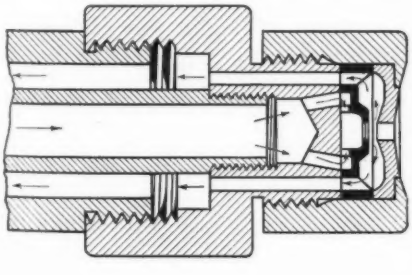
Burners employed for mechanical-atomizing installations fall into three broad ranges. In Fig. 6 and 9, a typical narrow-range (1 to 1.4) burner illustrates designs suitable for "interchange of burner tips" for extending capacity range of a given installation.

A plunger-type mechanical burner, Fig. 8, applied to marine use features additional holes opening tangentially in the nozzle as the oil pressure increases. With all the other conditions—oil viscosity, pressure and air—held the same as for conventional narrow-range burners, this design broadens the capacity range to 1 to 4.

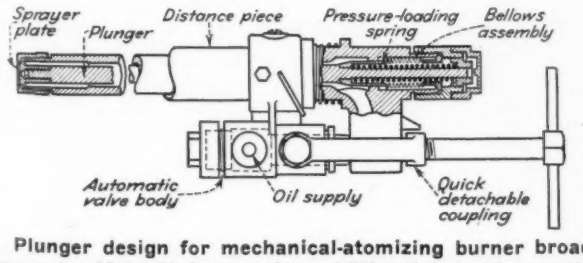
Still other systems for extending capacity range have been developed. One, Fig. 7 and 10, supplies a constant flow of fuel oil by primary pumping to the burner line. At this point a spe-



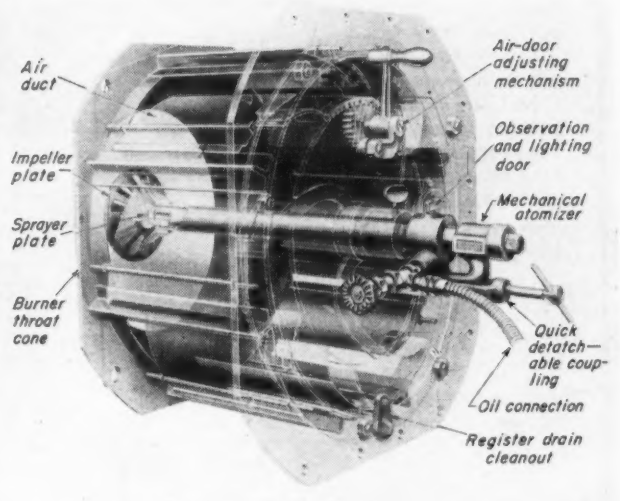
6 A mechanical-atomizing burner of the narrow-range (1 to 1.4) type, whose tip defines its capacity range



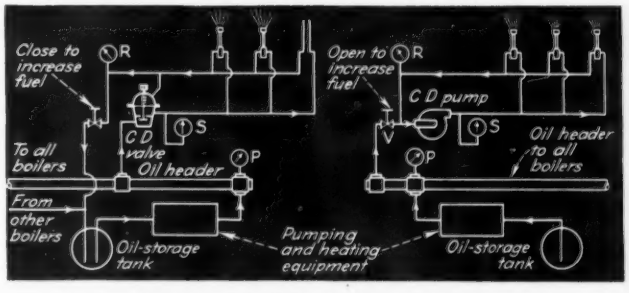
7 Variable capacity, mechanical-atomizing burner receives constant oil flow but discharges a varying amount to the furnace according to the steam demand



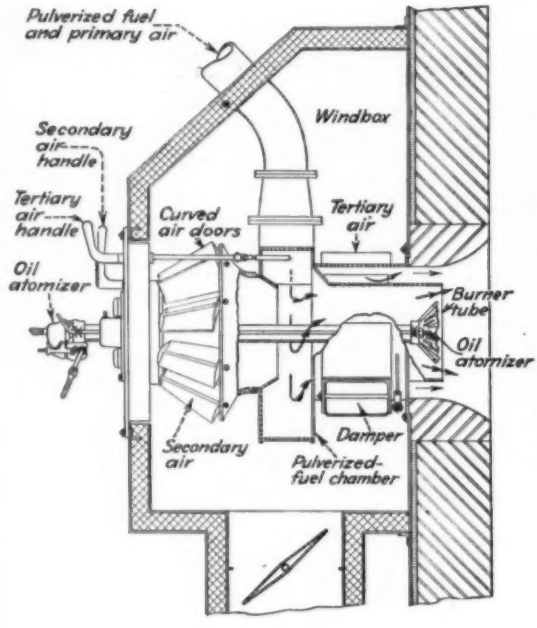
8 Plunger design for mechanical-atomizing burner broadens range (4 to 1) by opening additional holes in nozzle. These tangential holes open under pressure increase



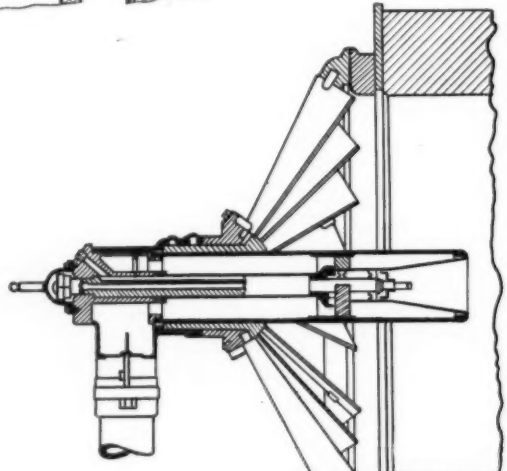
9 Mechanical-atomizing burner complete with air register. Optimum viscosity for fuel reaching burner tip is 150 ssu; best oil pressure is between 225 and 300 psi



10 This constant-differential atomizing design gives firing capacity range of about 14 to 1. A differential pump, controlled by demand, changes the fuel oil pressure

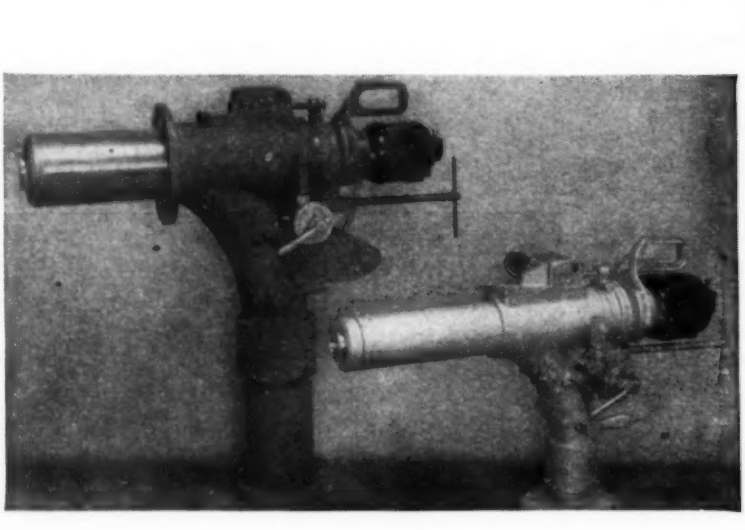


11 Combination pulverized-fuel and oil burner with primary, secondary and tertiary air supplies. These supplies develop proper turbulence of oil spray or coal at the burner outlet to give complete combustion. Combination designs have grown in importance with the unfavorable changes in fuel availability. Their ability to handle different fuel types separately or in combination is desirable feature nowadays



12 Rotary-cup oil burner atomizes oil by centrifugal force. Primary combustion air at high pressure drives a small air turbine coupled to the atomizing cup. It rotates at about 3500 rpm and atomizes oil of a viscosity of 300 ssu.

13 (below) Two rotary-cup burners with 2000 and 1000 lb per hr capacities



cial valve or pump (the "differential" pump) controlled by steam demand, changes fuel-oil pressure to atomize more or less fuel through the tips while the balance keeps circulating. This method, in use at the Harbor Steam Plant of the City of Los Angeles, has a range of firing capacity of about 14 to 1 with oil at a viscosity of 150 ssu, delivered to the differential pumps at 350 psi and to the burner at 500 psi.

Further designs contemplate a firing capacity range of 200 to 1 employing oil at 900 psi. All air for combustion enters through conventional air registers around the oil burner under a pressure of 2 to 8 in. of water.

Several manufacturers have developed burners capable of handling various types of fuels burned in suspension, either alternately or in combination, Fig. 11.

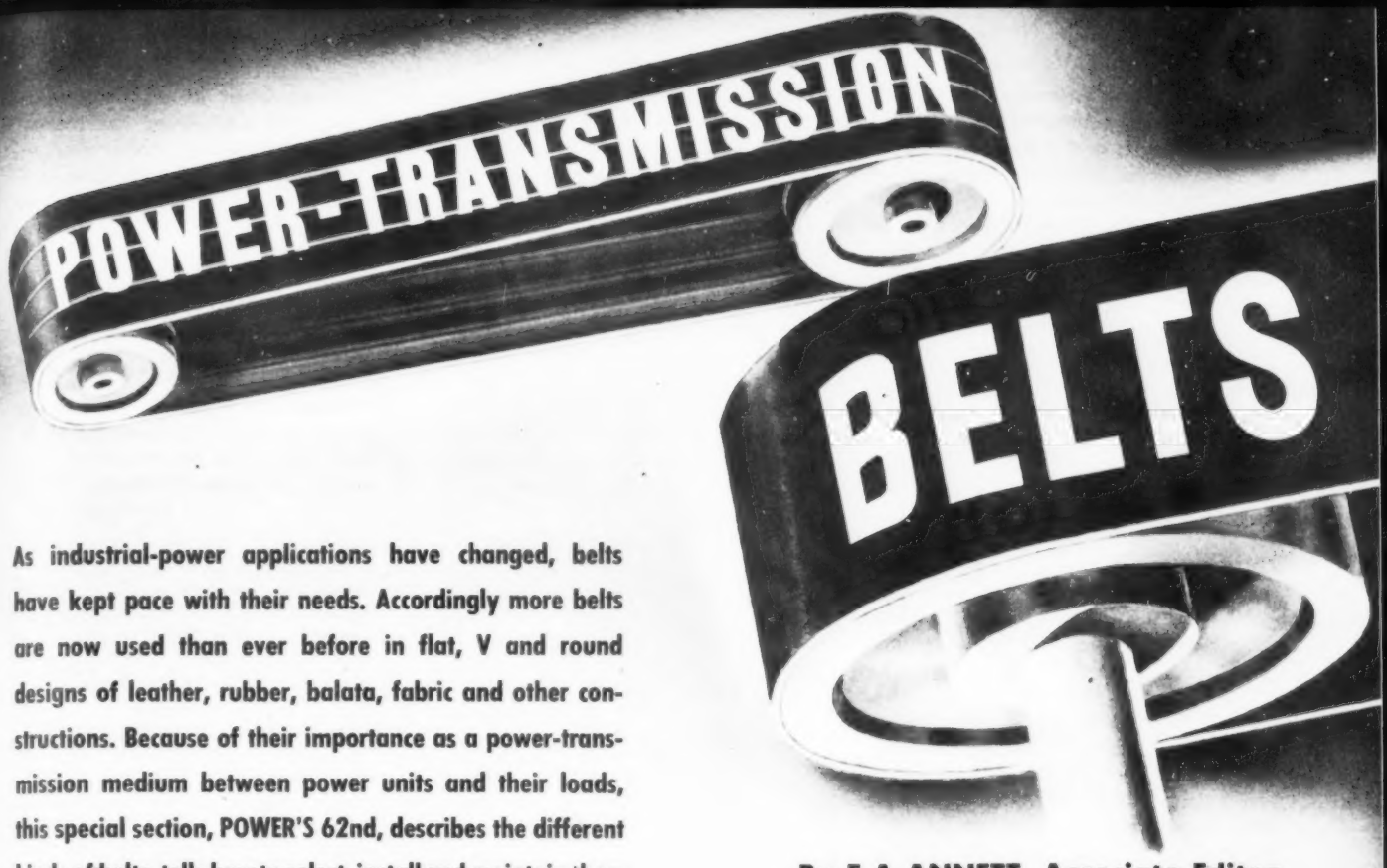
Horizontal Rotary-Cup Burners. Centrifugal force, developed at the rim of a horizontal cup, conical or cylindrical, rotating at 3500 rpm, atomizes the fuel oil. This system of atomizing, which requires no oil pressure beyond that needed to bring oil to the cup, proves attractive to installations where only low-pressure steam is available. Here high oil preheat temperatures cannot be obtained. The rotary cup will, however, atomize an oil of much higher viscosity (300 ssu) than will a mechanical atomizer (150 ssu). In fact, high oil temperatures with rotary-cup atomization may develop gasification.

Originally rotary-cup-burner design, Fig. 13, introduced primary air at high pressure to drive a small air turbine coupled to the atomizing cup; secondary air came from induced boiler draft. Today several designs exist, each with a specific application. In large applications separate burner units and blower units are installed. Fig. 13 shows one model with neither fan nor pumps.

Smaller-capacity designs combine burner, motor, regulating valve and fan. A fully automatic unit with an electric ignition spark that touches off a pilot-gas flame to ignite the oil flame whenever controls call for operation is one sample of this design on the market.

For units of small or medium capacities, some means of preheating oil before it reaches the burner under starting-up conditions may prove desirable. Various circuits and layouts have been developed to meet this need.

In general the rotary-cup oil burner has a wide range of firing capacity (16 to 1), and its application has proved successful on tankers and auxiliary ships where boilers are installed in connection with diesel engines.



As industrial-power applications have changed, belts have kept pace with their needs. Accordingly more belts are now used than ever before in flat, V and round designs of leather, rubber, balata, fabric and other constructions. Because of their importance as a power-transmission medium between power units and their loads, this special section, POWER'S 62nd, describes the different kinds of belts, tells how to select, install and maintain them

By F A ANNETT, Associate Editor

BELT CONSTRUCTIONS

Power-transmission belts are made of many materials, such as leather of several tannages, cotton fabrics of various weaves and construction, hair fabrics, rubber and fabric, balata and fabric, synthetic rubber and fabric, hemp rope, thin flat steel, and wire fabric. Singly or in combination, these materials are fabricated into flat, V-section and rounded belts.

Leather Belts. Among belt materials, leather has always held a prominent position. Best-quality belting is made from the rear back and sides of 3-to-4-year-old steers. Strips cut the desired width are cemented together to obtain belt length. A single thickness of leather makes a single-ply belt. For heavier loads, two plies cemented together make a double-ply belt. Large, heavy belts are 3-ply. Belt thickness varies with leather thickness and number of plies, and with manufacturer, but range is generally: single ply, ⅛ to 7/32 in.; double ply, ¼ to ⅜ in.; triple ply, 7/16 to 9/16 in.

Before assembling leather strips into a belt, ends are beveled, Fig. 1 on page 80, given a cement coat and pressed together, Fig. 2. For double-ply belts, two single plies are cemented, Fig. 3. A waterproof belt is made with waterproof cement. Hair or grain side of leather is always next to the pulley as it is smoother and has a higher coefficient of friction than the flesh side.

Other Constructions. A widely used leather belt has a ribbed surface, Fig. 4. The idea is that such a surface grips the pulley better than a smooth one. Advantages of two tanning processes are combined by making a belt with an outer ply of oak-tanned leather and an inner ply of chrome-tanned leather. Sometimes the chrome leather is cemented to the oak. Design in Fig. 5 has strips of soft chrome leather attached to oak leather with tubular rivets.

For operation on tapered-cone pulleys, the 2-ply belt, Fig. 6, has a wide outer ply of heavy oak-tanned leather and a narrower inner ply of high-friction special tannage. The plies are cemented and are also held with wire fasteners, countersunk so they cannot contact the pulleys.

A recent leather-belt development has continuous cords between two plies, Fig. 7, to reduce stretch. Flesh side of the inner ply is grooved lengthwise, and preshrunk cord is cemented in these grooves. The two plies are cemented as for any 2-ply belt. Another design reduces stretch by cementing a thin ply of hard, white rawhide between two plies of waterproof oak-tanned leather, Fig. 8. It is equivalent to a 3-ply belt with about the thickness of an extra-heavy 2-ply construction, and has same power-transmission rating.

Leather-Link Belts. One of several leather-link designs is shown in Fig. 9. Some designs have links of single-thickness leather, others of 2-ply leather. The links, with steel connecting pins, are assembled into belts, 0.5 to 1 in. thick and 1 to 24 in. wide, depending on the power and other requirements. These designs are used for heavy, slow-speed drives where a belt is subjected to abuse, and have a belt tightener for a clutch drive.

Leather V-Belts. Leather belts that have a V-cross-section to run in V-grooved sheaves are built in several designs. They are available in the same cross-sections as standard rubber V-belts, and run on the same sheaves. For solid V-constructions, Fig. 10, a sufficient number of plies are cemented for desired thickness. One design has a thin ply of grain-side leather cement-

ed to its V-sides that contact the sheave grooves. Other constructions have their plies cemented, and are either twine- or wire-stitched together. For greater flexibility, one design has the bottom ply in sections, riveted to the solid top ones. In another, bottom ply is notched crosswise, Fig. 12. These notches have a width and spacing to relieve bulging of the belt's V-sides.

In a third leather V-belt, links form a V, Fig. 11. This very flexible type for small sheaves is available in standard cross-sections. Links are so assembled that the inner end of each link overlaps a rivet. This construction prevents the rivets bottoming on the flat driven pulley of a V-flat drive.

Rounded Leather Belts. Solid rounded belts are made from ⅛ to ½ in. thick. Built-up designs range from ⅜ to 1½ in. diameter. These belts are made of two or more plies cemented and cable-screwed together to prevent ply separation. Rounded belts are also made of flat leather strips, folded, twisted or braided to correct size. They have greater flexibility than solid rounded belts, and come in sizes ⅛ to 1 in.

For difficult drives requiring a certain amount of slip between belt and sheave, rounded belts are made of leather tanned with the hair on. They are made in small sizes only — ⅛ to ⅜ in. Rounded leather belts are used on light machinery in textile, shoe and similar industries.

Flat Rubber Belts. Rubber belts are made in several shapes and constructions using rubber and synthetic-rubber compounds. These give (1) varying degrees of strength, stretch, pulley grip and smoothness (2) protection against abrasion, oil, moisture and corrosive fumes. Cotton and rubber, or synthetic-rubber compounds are used in nearly all power-transmission rubber belting.

Rubber belting comprises layers (plies) of cotton duck impregnated, or "frictioned," with a slow-aging rubber compound. Weights of cotton ducks are 24, 28, 32, 36, 42 and 48 oz. These values represent weight of a 36 x 42-in. piece of dry duck. The 32-oz ducks are most commonly used in rubber power-transmission belts.

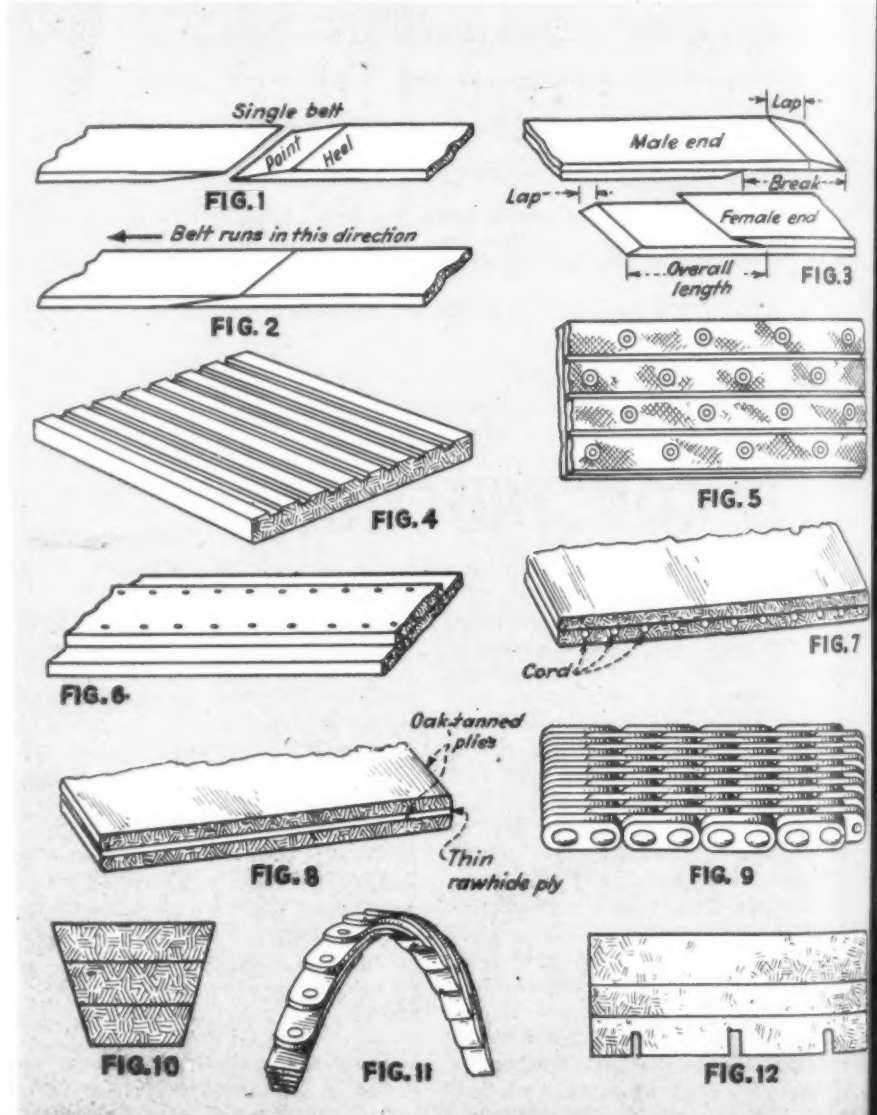
The duck is first frictioned with slow-aging rubber compound, forced into it by heavy pressure between calender rolls. For desired belt width and number of plies, the duck is folded, then vulcanized in a press. Rubber belts have raw edges, Fig. 13, unless conditions are unfavorable; in such cases they are of folded construction, Fig. 14.

Endless-Cord Belts. Most general-purpose rubber belts are friction-surfaced only; that is, rubber is put only into the duck, before the plies are put together. For operations where steam, acid fumes or abrasive dusts are present, belts are made with rubber coverings to protect fabrics. Another construction has one or two layers of rubberized cord, Fig. 15 and 16, laid parallel along the belt center to take the load. This produces an endless belt without a splice. Cords are imbedded in rubber and encased in a frictioned-fabric envelope.

Fig. 17 shows another belt built around two sets of cords. Large cords, in top side of belt, are intended to hold the load-pulling smaller cord section against the pulley. Both layers of cords are imbedded in rubber compound. An outer heavy-fabric jacket incloses and protects cords from wear and atmospheric conditions.

For great strength, a flat rubber belt is built with a load-carrying core of fine-strand, high-tensile-strength, endless steel cables, Fig. 18. Otherwise, this belt is constructed like the belt in Fig. 15, but it has double the power-transmitting capacity per inch width. Its steel-cable core does not stretch.

Rubber V-Belts. V-belts are of rubber or of synthetic rubber and cotton, but design varies with manufacturer. They are trapezoidal in cross-section, Fig. 19, and run in grooved sheaves. When



1 to 3 Single- and double-ply flat leather belts. 4 This flat leather belt is grooved on inner surface to increase its coefficient of friction 5 Combination oak- and chrome-leather belt. 6 Two-ply leather belt for tapered-cone pulleys. 7 Two-ply leather belt with continuous cords set in the inside ply to reduce stretch. 8 Rawhide ply between two oak-tanned plies reduces belt stretch. 9 Leather-link belt. 10 A cross-section of leather V-belt. 11 This V-belt is made of leather links. 12 To increase flexibility bottom ply in this leather V-belt is notched.

a belt is bent around a pulley its outside zone *A* is in tension, center zone *B* is neutral, inner zone *C* is in compression. The neutral zone is always the power-transmitting section.

In V-belt, Fig. 20, load is carried entirely by a layer of heavy, high-tensile endless cord, impregnated with liquid rubber, and placed in the belt's neutral zone. Tension zone above the cord is of rubber stock, while compression zone is of fabric cord and rubber. A fabric envelope impregnated with rubber compound takes belt wear.

Fig. 21 shows a belt with load-carrying sections of several layers of pre-stretched cord, impregnated with rubber compound. Above these sections, a tension section of layers of impregnated bias-cut fabric gives the belt transverse stiffness against buckling between the grooves' sides. Below the cord a rubber section serves as the compression member. A fabric envelope incloses the entire belt. Other designs have two layers of cord.

In Fig. 22 the tension section is of rubber - impregnated bias - cut fabric, the load-carrying section of cord fabric, and a compression section of rubber, corrugated to help take compression effects. This belt has no envelope.

V-belts have straight V-sides, Fig. 20 to 22, and concave sides, Fig. 23. Latter is so designed that when it bends around a sheave its sides become straight to fit the sheave grooves. Bottom half of this belt is composed of layers of fabric cut bias to give flexibility, and held together by rubber pressed into the fabric. Above the under core are layers of rubber-saturated cord, vulcanized into the belt's rubber.

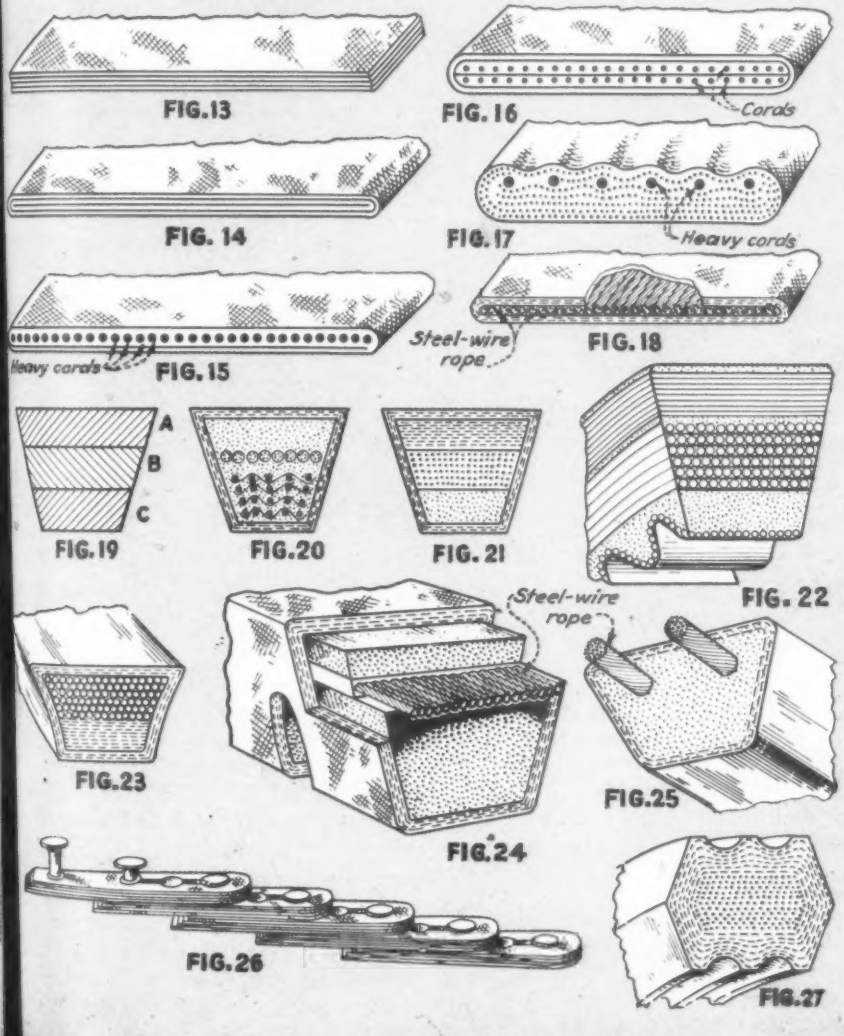
Steel-Wire V-Belts. One of the latest V-belts has a layer of endless, finely stranded steel cables, inclosed in rubber to form the load-carrying section, Fig. 24. Its compression section is deeply notched, as shown, to eliminate over-compression when bending around small sheaves and to help dissipate the heat of flection. Another design has two continuous-steel-wire grommets covered with rayon cord, Fig. 25, in place of the layer of steel cables, Fig. 24. These designs are for applications requiring great strength and minimum stretch.

Built of tapered sections cut from special, flat rubber belt, the V-belt, Fig. 26, can be made endless on the job. Each tapered section has three holes, which permit assembly on rivets to form a continuous length, as shown. These belts have standard *A, B, C, D* and *E* cross-sections. Other V-belts are available, but the designs described give a general idea of the different constructions.

Double-angle V-belts, Fig. 27, are applied where power must be transmitted to grooved sheaves from both top and bottom of belt. Such drives permit powering any number of driven sheaves from a common driver, and also allow one or more driven shafts to operate in reverse direction without crossing the belt.

A V-belt drive may comprise from 1 to 30, or more, strands in multiple. These belts originally operated on two V-grooved sheaves only. Now, they sometimes drive a large, flat pulley with little or no crown from a small V-grooved sheave, and are known as V-flat drives. Multiple V-belts generally operate on straight open applications, but have been developed for most services where flat belts can be used. Rounded rubber belts are made in many constructions and sizes.

Other Belt Materials. Flat fabric belts are impregnated with balata, a vegetable gum resembling gutta-percha, obtained from the sap of South American trees. Canvas belting is made in several forms. There are several types of hair belts, generally known as camel's hair. Many metal belts are used, particularly for high temperatures. Metal belts are also made in a variety of wire meshes, similar to wire fences.



13 Raw-edge friction-surfaced rubber belt. 14 A friction-surfaced folded-edge rubber belt. 15 to 17 Three different constructions of cord rubber belts. 18 The strength member of this flat rubber belt is finely stranded steel rope. 19 *A* is the tension zone; *B* is the neutral zone; and *C* is the compression zone of a V-belt. 20 to 23 Four constructions of rubber, fabric and cord V-belts. 24 and 25 The steel-wire rope is the strength member of these two high-duty V-belts. 26 This rubber V-belt is assembled from flat links. 27 This is a double-angle V-belt

BELT SELECTION

Selection of a belt merits the same engineering consideration as that of a power unit and its control for a given application. Unless all are suited to the job the drive cannot be expected to operate at high efficiency and reliability. When making a selection, favor a belt a little over capacity. It pays big dividends in increased life and trouble-free service, whereas an undersized one may be a source of trouble. Thanks to the belting associations and manufacturers, belt selection has been reduced to the use of a few simple equations and tables that are given here.

Flat Belts. Flat belts are adapted to high- or low-speed applications. They are readily used for speeds up to 5000 ft per min, and have been operated at twice that speed. Up to about 5000 ft per min, power-transmitting capacity of a given belt increases with speed; beyond this, centrifugal force and other factors cause reduced belt capacity.

Belts are readily adapted to changed conditions. Their length can be increased or decreased easily to meet changed drive requirements, and they can be operated on either long or short centers. At one time a long-center drive with the slack side on top was the most desirable arrangement, but development of pivoted and tension bases for motors has made short-center drives as satisfactory as long ones.

Pivoted or Tension Bases. Mounted on a pivoted or tension base, part of the motor's weight is balanced against the tension of the two belt strands. These bases have been developed for mounting motors in almost any position. The motor's position can be adjusted on its base to operate with the minimum belt tension required to drive the load.

On applications where pulley ratios are small, these drives may operate on center distances so short that the pulleys just clear. For instance, 7.5-hp 1750-rpm motors drive spinning frames with only 10 in. between shaft centers. These drives are also suited to large pulley ratios with short-center distances comparable to or shorter than idler applications. As an example, a 15-hp 1150-rpm motor drives a paper calender through a belt on 32-in. centers for 8 to 1 speed reduction.

Leather Belts. Leather belts are available in medium and heavy single ply; light, medium and heavy double ply; medium and heavy triple ply. Average thickness of these belts ranges from 11/64 in. for medium single ply to 34/64 in. for heavy triple ply. Because most triple-ply belts are constructed for particular drives, belting manufacturers should be consulted for specific information on them.

Selection of flat leather belts for most applications has been standardized by the American Leather Belting Association, New York, N. Y. Table I from these standards lists normal horsepower ratings per inch of leather-belt width at different speeds when driving and driven pulleys are the same size. Across the bottom of this table are minimum pulley diameters for different belt thicknesses and widths, and at the top are given belt thicknesses and number of plies.

As an example, find the minimum pulley diameter for a double-ply medium belt. Locate double ply medium at top of table and follow down this column; for belts under 8 in. wide a minimum pulley diameter of 8 in. is permitted. For belts 8 in. wide and over, pulley diameter should be not less than 10 in. Values in the main body of the table are horsepower per inch of belt width at different speeds in feet per minute. Following across the table, from 3000 ft per min in the left-hand column, we find a medium double-ply belt is good for 8.7 hp per in. of width, in the fifth column from the left.

Belt Capacity. Most power applications require a belt of higher rating than the power unit selected to drive the load. Furthermore, a belt that may be of ample capacity for a power unit on one kind of load may not be satisfactory for the same horsepower unit under another set of conditions.

Conditions that influence the size of belt required to connect a given power unit to its load are influenced by (1) atmospheric conditions (2) angle at which the belt operates (3) kind of small pulley (4) distance between pulleys (5) kind of service (6) load characteristics (7) type of power unit and starting method.

The job of selecting a belt is not quite so complicated as it may sound

TABLE I — HORSEPOWER RATING OF FLAT LEATHER BELTS PER INCH OF WIDTH

Belt Speed ft per min	Single Ply		Double Ply			Triple Ply	
	11/64 In. Medium	13/64 In. Heavy	18/64 In. Light	20/64 In. Medium	23/64 In. Heavy	30/64 In. Medium	34/64 In. Heavy
600	1.1	1.2	1.5	1.8	2.2	2.5	2.8
800	1.4	1.7	2.0	2.4	2.9	3.3	3.6
1000	1.8	2.1	2.6	3.1	3.6	4.1	4.5
1200	2.1	2.5	3.1	3.7	4.3	4.9	5.4
1400	2.5	2.9	3.5	4.3	4.9	5.7	6.3
1600	2.8	3.3	4.0	4.9	5.6	6.5	7.1
1800	3.2	3.7	4.5	5.4	6.2	7.3	8.0
2000	3.5	4.1	4.9	6.0	6.9	8.1	8.9
2200	3.9	4.5	5.4	6.6	7.6	8.8	9.7
2400	4.2	4.9	5.9	7.1	8.2	9.5	10.5
2600	4.5	5.3	6.3	7.7	8.9	10.3	11.4
2800	4.9	5.6	6.8	8.2	9.5	11.0	12.1
3000	5.2	5.9	7.2	8.7	10.0	11.6	12.8
3200	5.4	6.3	7.6	9.2	10.6	12.3	13.5
3400	5.7	6.6	7.9	9.7	11.2	12.9	14.2
3600	5.9	6.9	8.3	10.1	11.7	13.4	14.8
3800	6.2	7.1	8.7	10.5	12.2	14.0	15.4
4000	6.4	7.4	9.0	10.9	12.6	14.5	16.0
4200	6.7	7.7	9.3	11.3	13.0	15.0	16.5
4400	6.9	7.9	9.6	11.7	13.4	15.4	16.9
4600	7.1	8.1	9.8	12.0	13.8	15.8	17.4
4800	7.2	8.3	10.1	12.3	14.1	16.2	17.8
5000	7.4	8.4	10.3	12.5	14.3	16.5	18.2
5200	7.5	8.6	10.5	12.8	14.6	16.8	18.5
5400	7.6	8.7	10.6	12.9	14.8	17.1	18.8
5600	7.7	8.8	10.8	13.1	15.0	17.3	19.0
5800	7.7	8.9	10.9	13.2	15.1	17.5	19.2
6000	7.8	8.9	10.9	13.2	15.2	17.6	19.3
Minimum pulley dia. in. — Belts under 8 in. wide	3	5	6	8	12	20	24
Minimum pulley dia. in. — Belts 8 in. wide and over	—	—	8	10	14	24	30

These are minimum allowable pulley diameters for the corresponding belt thickness at top of this table.

because the Engineering Committee of the American Leather Belting Association reduced it to a simple equation:

Belt width $= MR \div KP$

where M is a constant depending on the motor's characteristics and method of starting, Table II; R is the nameplate rating of the driving motor; K, a constant taken from Table I, is the theoretical horsepower transmitted by a belt of given thickness and one inch wide; P, a correction factor depending on the size of the small pulley, is given in Table III.

In the equation no consideration is given to the center distance between pulleys because it is assumed that all motors operating on short-center drives will be mounted on a pivoted or tension base. In such case the drive becomes the equivalent of one operating on a long center.

Selection Example. Assume a lineshaft driven by a 40-hp 1150-rpm normal-torque line-start squirrel-cage motor on a pivoted or tension base, belted to the driven shaft to operate at 380 rpm. In this problem we must first determine the driven pulley's diameter. Because a belt speed of 4000 ft per min or over is usually the most economical, take 4200. Pulley diameter equals belt speed divided by 0.262 times shaft speed.

Then, driven-pulley diameter $= 4200 \div (0.262 \times 380) = 42.2$ in.

By same method, motor-pulley diameter $= 4200 \div (0.262 \times 1150) = 13.93$ in. We can use a 42-in. driven pulley and a 14-in. motor pulley.

Referring to Table IV we find that a 14-in. pulley comes within the recommended sizes for a 40-hp 1150-rpm motor. The smallest-sized pulley given for each motor is the NEMA standard and the recommended minimum. In Table I we find that a heavy double-ply belt can be used on a 14-in. pulley. As a trial, let us use a medium double-ply belt, which is more flexible than a heavy double-ply, and is preferred unless it requires an excessive width.

At 4200 ft per min this belt can transmit 11.3 hp per in. of width, Table I. Table III gives the correction factor $P = 0.8$ for the smallest pulley. Since the motor is a normal-torque line-start squirrel-cage, use a motor constant $M = 2$, Table II. We now have all the values from which to calculate the belt's width, which is:

Width $= (2 \times 40) \div (11.3 \times 0.8) = 9$ in.

We can use this width belt and it will run on a 14x9 ¾-in. motor pulley, as shown in the third column from the right in Table IV on the line for 40 hp and 1150 rpm.

Belt Length. The belt's length can be determined by applying the equation:

TABLE II — CORRECTION FACTORS FOR MOTOR TYPE AND STARTING METHOD

Motor type and starting method	*Correction factor, M*
Squirrel cage, compensator starting	1.5
Squirrel cage, line starting	2
Slip ring and high starting torque	2.5

TABLE III — CORRECTION FACTORS FOR SMALL PULLEY DIAMETERS

Diameter of small pulley, in.	*Correction factor, P*
4 and under	0.5
4½ to 8	0.6
9 to 12	0.7
13 to 16	0.8
17 to 30	0.9
Over 30	1.0

TABLE IV — RECOMMENDED MOTOR-PULLEY DIMENSIONS BASED ON HORSEPOWER AND SPEED ALSO MAXIMUM PULLEY AND BELT WIDTH PERMITTED ON OVERHUNG MOTOR SHAFT

Motor		Motor-Pulley Dimensions, In.					Max Width, In.[1]		Motor		Motor-Pulley Dimensions, In.				Max Width, In.	
Hp	Rpm	Dia x width	Dia x width	Dia x width	Dia x width	Dia x width	Pulley	Belt	Hp	Rpm	Dia x width	Dia x width	Dia x width	Dia x width	Pulley	Belt
1	1750	3x2½	3½x2	4x2	4½x2½	5x2½	3	2½	20	850	10x9¾	11x8¾	12x7¾	13x6¾	11	10
1	1150	3x3½	3½x2½	4x2½	4½x2½	5x2½	3	2½	20	690	11x11	12x9¾	13x8¾	14x7¾	13	12
1	850	4x3½	4½x2½	5x2½	5½x2½	6x2½	4½	4	25	1750	9x7¾	10x6¾	11x6¾	12x6¾	9¾	9
2	1750	4x3½	4½x2½	5x2½	5½x2½	6x2½	4½	4	25	1150	10x9¾	11x8¾	12x7¾	13x6¾	11	10
2	1150	4x4½	4½x3½	5x3½	5½x3½	6x3½	4½	4	25	850	11x11	12x8¾	13x8¾	14x7¾	13	12
2	850	4½x4½	5x4½	5½x4½	6x3½	7x3½	4½	4	25	690	11x13	12x11	13x9¾	14x9¾	13	12
3	1750	4x4½	4½x3½	5x3½	5½x3½	6x2½	4½	4	30	1750	10x8¾	11x7¾	12x7¾	—	11	10
3	1150	4½x5½	5x4½	5½x4½	6x3½	7x3½	4½	4	30	1150	11x9¾	12x8¾	13x7¾	14x7¾	13	12
3	850	5x5½	5½x4½	6x4½	7x4½	8x3½	5½	5	30	850	11x13	12x11	13x9¾	14x9¾	13	12
5	1750	4½x5½	5x4½	5½x4½	6x4½	7x4½	4½	4	30	690	12x13	13x11	14x9¾	—	13	12
5	1150	5x6¾	5½x5½	6x5½	7x4½	8x4½	5½	5	40	1750	11x9¾	12x9¾	—	—	13	12
5	850	6x5½	7x5½	8x4½	9x3½	10x3½	6¾	6	40	1150	11x13	12x13	13x11	14x9¾	13	12
5	690	8x5½	9x4½	10x3½	11x3½	12x3½	7¾	7	40	850	12x15	13x13	14x11	15x10	15	14
7½	1750	5x6¾	5½x5½	6x5½	7x4½	7x4½	5½	5	40	690	14x13	15x13	16x11	—	15	14
7½	1150	6x6¾	7x5½	8x5½	9x4½	10x3½	6¾	6	40	575	14x15	15x15	16x13	—	15	14
7½	850	8x6¾	9x5½	10x4½	11x4½	12x4½	7¾	7	50	1150	12x13	13x11	14x11	15x10	15	14
7½	690	9x6¾	10x5½	11x5½	12x4½	13x4½	9¾	9	50	850	14x13	15x13	16x11	—	15	14
10	1750	6x5½	7x5½	8x4½	9x4½	10x3½	6¾	6	50	690	15x15	16x15	17x13	—	17	16
10	1150	8x5½	9x4½	10x4½	11x3½	12x3½	7¾	7	50	575	16x17	17x15	18x13	—	17	16
10	850	9x5½	10x5½	11x4½	12x4½	—	9¾	9	60	1150	14x13	15x13	16x11	—	15	14
10	690	10x6¾	11x5½	12x5½	13x4½	—	11	10	60	850	14x15	15x15	16x15	—	15	14
15	1750	8x5½	9x4½	10x4½	11x4½	12x4½	7¾	7	60	690	15x17	16x17	17x15	—	17	16
15	1150	9x6¾	10x5½	11x5½	12x5½	13x4½	9¾	9	60	575	16x17	17x17	18x15	—	17	16
15	850	10x7¾	11x6¾	12x6¾	13x5½	—	11	10	75	1150	14x15	15x15	16x15	—	15	14
15	690	10x8¾	11x7¾	12x7¾	13x6¾	—	11	10	75	850	15x17	16x17	17x17	—	17	16
20	1750	9x6¾	10x5½	11x5½	12x5½	—	9¾	9	75	690	16x19	17x17	18x17	—	19	18
20	1150	10x7¾	11x6¾	12x6¾	13x5½	14x5½	11	10	75	575	16x21	17x21	18x19	—	19	18

[1]Maximum pulley and belt widths permitted because of motor-bearing loads. If wider pulley and belt are required, install outboard bearing.

TABLE V—MOTOR-HP CORRECTION FACTORS FOR SEVERE OPERATION

Operating conditions	*Factors*
Oily, wet or dusty atmosphere	1.35
Vertical drives	1.2
Jerky loads	1.2
Shock and reversing loads	1.4

$$\text{Length} = 2C + [1.57 \times (D+d)] + \frac{(D-d)^2}{4C}$$

where C equals the distance between the motor and driven-shaft centers in inches; D and d equal the diameters of the large and small pulleys in inches, respectively. Assuming a 60-in. center distance:

$$\text{Length} = (2 \times 60) + [1.57 \times (42+14)] + \frac{(42-14)^2}{4 \times 60} = 211 \text{ in.}$$

If the belt is to be spliced, add the length of splice to calculated length.

The method used in selecting this belt is for average conditions for motor drives found in industry. Occasionally conditions make it advisable to use an oversize belt. Table V covers most of these conditions, and the power for which the belts is calculated should be increased by one of these factors. In our problem we multiplied the motor horsepower by 2 when determining the belt width. If the belt had to operate in a very dusty atmosphere, this condition should be taken into account by using the factor 1.35, Table V. This raises the belt horsepower to 2x40x1.35 = 108 hp, which would require a medium, double belt 12 in. wide, or a heavy double one, 9 in. wide. Either is permitted on a 40-hp 1150-rpm motor without going to an outboard bearing, Table IV.

Motor-Bearing Loads. If the diameters of the pulleys are limited, the smaller one may be under the minimum recommended size. When these conditions exist a wider belt that is lighter and more flexible must be used. The wider the belt, the greater the load on the motor's bearing next to the pulley. To guard against too high bearing pressures and shaft deflection that might cause bearing troubles, motor manufacturers limit belt width that should be used. Table IV gives the widest pulley recommended for different horsepowers and speeds.

In this table 40 hp is the largest 1750-rpm motor recommended for an overhung pulley. This pulley, 13 in. wide, permits using a 12-in. belt. If this belt is not wide enough for the drive some change must be made. If the pulleys' diameters cannot be increased to increase the belt's speed and power, or a lower-speed motor cannot be used to permit a larger-drive pulley and heavier belt, then a wider pulley and belt will have to be installed with an outboard bearing on the motor.

A belt can be used somewhat narrower than that calculated, but at the expense of belt life. If needed, it is usually best to go to an outboard bearing where the belt width justifies doing so, rather than to use a narrower belt on an overhung pulley.

Flat Rubber Belts. Flat rubber belts, as shown on page 81, are built in several designs, and this influences their ratings. Their applications, however, are made like those of leather belts. Factors that are unfavorable to one kind generally have a similar effect on the others. Rubber belts are applied to short-center drives with motors mounted on pivoted or tension bases, with the same favorable results as for leather belt.

As already shown for leather belts, most power applications require a belt of higher rating than that of the power unit. Allowance must be made for character of load, types of motor, method of starting and other conditions by the use of service factors, such as are given in Table VI. Belts are generally rated at 180-deg contact on their pulleys. When the contact is less than this, which it usually is, a correction must be made. This can be done with Table VII.

Selection Example. Assume a fan driven at 350 rpm by a 25-hp 1150-rpm squirrel-cage normal-torque line-start motor, the center-to-center distance being 6 ft.

Belt hp = motor hp x service factor x arc-of-contact factor. Service factor for a squirrel-cage normal-torque motor driving a fan is 1.6, as found in Table VI. Assume the fan to be equipped with a 40-in. pulley. The motor pulley will have to be 40x350 ÷ 1150 = 12.2 in., say 12 in. The arc of contact made by the belt on the small pulley is:

$$\text{Arc of contact} = 180 - \frac{60\,(D-d)}{C}$$

where C equals the distance between centers of driving and driven shafts, and D and d equal larger and small pulley diameters, respectively. Then,

$$\text{Arc of contact} = 180 - \frac{60\,(40-12)}{60} = 152 \text{ deg}$$

Table VII gives a correction factor of 1.14 for 150-deg arc of contact. Power

TABLE VI—SERVICE FACTOR TO CORRECT FOR MOTOR TYPE, STARTING METHOD AND KIND OF LOAD

	Electric Motors									*Engines*		
	Alternating current							*Direct current*				
	Squirrel cage			*Synchronous*			*Single phase*					
Applications	*Normal torque, line start*	*Normal torque, compensator start*	*High torque*	*Wound rotor (slipring)*	*Normal torque*	*High torque*	*Repulsion and split phase*	*Capacitor*	*Shunt wound*	*Compound wound*	*Gas and diesel 4 or more cyl, above 700 rpm*	*Steam*	*Lineshafts and electric starting*
Agitators, paddle-propeller	1.2	1.0	1.4	1.2	—	—	—	—	—	—	—	—	1
Brick and clay machinery	1.5	1.3	1.8	1.5	—	—	—	—	1.4	—	—	—	2.0
Bakery machinery	1.2	—	—	—	—	—	1.2	1.0	—	—	—	—	1
Compressors	1.4	1.4	—	1.5	1.5	—	1.2	1.2	1.2	—	1.2	—	—
Conveyors	—	1.6	1.8	—	—	—	—	—	1.6	—	—	—	1.8
Crushing machinery	—	1.4	1.6	1.4	1.4	1.6	—	—	—	1.6	1.6	—	1.8
Fans and blowers	1.6	1.6	2.0	2.0	2.0	2.0	—	—	1.4	—	1.6	1.5	1.5
Flour-feed-cereal-mill machinery	1.4	1.4	1.6	1.4	1.4	—	—	—	—	—	1.8	—	—
Generators, exciters	1.2	—	—	—	—	—	—	—	1.2	—	2.0	1.4	1.4
Laundry machinery	1.2	—	—	—	—	—	—	—	—	1.2	—	—	—
Lineshafts	1.4	1.4	—	1.4	1.4	2.0	1.4	1.4	1.4	1.4	1.6	1.6	1.8
Machine tools	1.2	—	—	1.4	—	—	1.2	1.2	1.2	1.2	—	—	—
Mills	—	1.6	1.6	1.4	—	—	—	—	—	1.4	—	—	1.8
Oil-feed machinery	1.2	1.2	1.4	—	—	—	—	—	1.4	1.4	1.4	1.4	1.4
Paper machinery	1.5	1.4	1.8	1.5	1.6	1.8	—	—	1.5	1.5	—	—	1.8
Printing machinery	1.2	1.2	—	1.2	—	—	—	—	1.2	1.2	—	—	—
Pumps	1.4	1.4	1.4	1.6	1.6	1.8	1.2	1.2	1.2	—	2.0	2.0	—
Rubber-plant machinery	1.4	1.4	1.4	1.4	—	1.8	—	—	—	—	—	2.0	—
Screens	1.2	1.2	1.4	—	—	—	—	—	—	—	—	—	—
Textile machinery	1.6	—	1.8	—	—	—	—	—	—	—	—	—	—

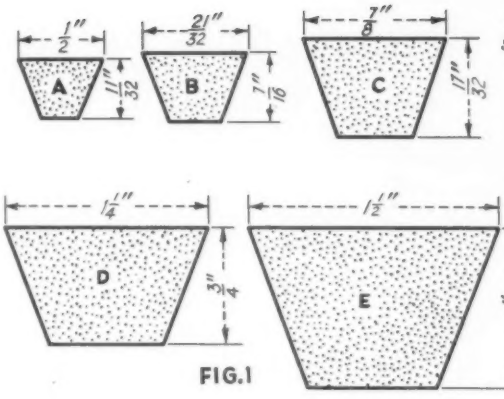


FIG. 1

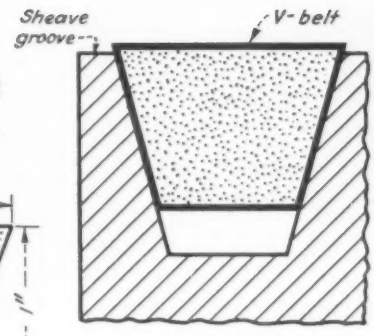


FIG. 2

TABLE VII—FACTORS BY WHICH TO MULTIPLY MOTOR HORSEPOWER

If arc of contact on small pulley is less than 180 deg.

Arc of contact, deg	Correction factor	Arc of contact, deg	Correction factor
180	1.00	120	1.35
170	1.04	110	1.45
160	1.08	100	1.57
150	1.14	90	1.70
140	1.20	80	1.83
130	1.27	70	2.00

1 **V-belts are made in five standard cross-sections, designated *A, B, C, D* and *E*.**
2 **Sheave grooves are practically same size as belts, but cut about 3/16 in. deeper**

for which the belt must be designed is:

Belt hp = 25x1.6x1.14 = 45.6 hp, say 46 hp

To determine the size of belt we must find its speed in feet per minute.

Belt speed = $0.262DS$

where D is the motor's pulley diameter in inches, and S is motor rpm. Then,

Belt speed = 0.262x12x1150 = 3616 ft per min, say 3600

Table VIII gives minimum pulley diameters for a given number of plies and permissible horsepower ratings of flat rubber belts per inch of width. Looking under belt speed of 2000-4000 ft per min we find that with a 12-in. pulley a 6-ply belt can be used, but we will select a 5-ply as this is a little more flexible. Following across the table from 5-ply to the 3500-ft-per-min column, we find that this belt is good for 6.8 hp per inch of width. Our belt is to operate at 3600 ft per min so 6.8 is on the safe side.

Belt width = belt hp ÷ hp per in. of width, or 46 ÷ 6.8 = 6.7

Therefore, use a belt 7 in. wide. In Table IV a 12x7¾-in. pulley is a recommended size for a 25-hp motor. Also, we can use an overhung pulley up to a 10-in.-wide belt on a 25-hp 1150-rpm motor, so our pulley dimensions are conservative. Table IX gives four plies as the minimum recommended number for a 6- or an 8-in. wide belt and six plies as the maximum number. Our belt design falls in between these limits, and dimensions are therefore satisfactory.

These calculations apply to conventional high-friction flat belts. Where special designs are being considered use horsepower ratings and pulley diameters, which can be obtained from the belt manufacturers. Special problems due to limitation in pulley sizes, severe-load conditions, and other factors require special treatment on which the belt manufacturer's advice will be found helpful. In any case have him check your calculations. It doesn't cost anything, and it may save you money.

Rubber V-Belts. Correct selection of V-belts for the average installation is comparatively easy if a few simple but important rules are followed. These belts are made in five standard cross-sections, designated *A, B, C, D* and *E*, Fig. 1. Sheave grooves, Fig. 2, are practically the same size as the belts, but are cut about 3/16 in. deeper than the belts that run in them.

Rubber V-belts can be run in any position from horizontal to vertical when the application is correctly designed. Although generally operated straight they are applied to crossed, quarter-turn, reverse and other drives.

To assist in selecting V-belts all manufacturers publish horsepower-rating tables of their belts on different-sized sheaves and for speeds up to 5000 ft per min, as in Table X. Standard belt sections and sheave diameters are given in the two left-hand columns. The other columns give belt-hp ratings for a given-size sheave and speed.

For example, a *B*-section belt, running at 3500 ft per min on a 6.2-in. pitch-diameter sheave is good for 4.4-hp load. For each size belt, ratings given for the largest-diameter sheave apply for all larger diameters. That is, a *C*-section belt running 3000 ft per min on a 12-in. sheave is rated 9.8 hp. This rating holds for all larger-sized sheaves and the same belt speed.

Belt Ratings. Ratings in Table X are for belts making 180-deg contact with their sheaves, as when both sheaves are the same diameter. On most drives the sheaves are not of equal diameter and their belts make less than 180-deg contact on the small sheave. To correct for this in belt calculations a factor is used, from Table VII, as for flat belts.

Kind of load, type of power unit, and starting method must also be taken into account. This is done, as for flat belts, by using Table VI. To indicate how V-belt drives are selected assume an air compressor driven at 300 rpm by a 50-hp 1150-rpm normal-torque line-start squirrel-cage motor.

Sheave Size. If possible select a motor sheave that gives a belt speed of about 4000 ft per min, as this is usually economical:

Sheave-pitch diameter = belt speed ÷ (0.262 x shaft speed) or 4000 ÷ (0.262x1150) = 13.3 in. Therefore, take 13 in. With this size sheave either a *C*- or *D*-section belt can be used.

TABLE VIII—MINIMUM PULLEY DIAMETERS AND PERMISSIBLE HP OF RUBBER BELTS PER IN. OF WIDTH

180-degree arc of contact

	Minimum Pulley Diameter, In.			*Maximum Permissible Horsepower per In. of Belt Width, Based on 180-Deg Arc of Contact*									
	Speed, ft per min			*Belt speed, ft per min*									
Plies	Under 2000	2000-4000	Over 4000	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500
3	3	4	5	1.2	1.8	2.4	2.9	3.5	4.0	4.3	4.6	4.9	5.2
4	5	6	8	1.7	2.5	3.2	4.0	4.7	5.4	5.8	6.2	6.6	7.0
5	7	8	10	2.1	3.1	4.1	5.0	5.9	6.8	7.5	7.9	8.4	8.8
6	10	12	14	2.7	3.9	5.2	6.4	7.5	8.5	9.4	10.2	10.8	11.1
7	14	16	18	3.1	4.5	6.0	7.4	8.7	10.0	10.7	11.6	12.7	13.0
8	18	20	22	3.5	5.2	6.9	8.5	10.0	11.4	12.4	13.3	14.1	14.8
9	22	24	28	4.0	5.8	7.7	9.6	11.2	12.9	14.0	15.0	15.9	16.7
10	28	32	36	4.4	6.5	8.6	10.6	12.4	14.3	15.5	16.7	17.7	18.6
12	36	42	48	5.3	7.8	10.3	12.8	15.0	17.2	18.6	20.0	21.2	22.3

TABLE IX — RECOMMENDED NUMBER OF PLIES FOR RUBBER TRANSMISSION-BELT WIDTHS

Belt width, inches	Minimum No. of plies	Maximum No. of plies	Belt width, inches	Minimum No. of plies	Maximum No. of plies
2	3	5	16	5	8
3	3	6	18	5	8
4	3	6	20	5	9
5	4	6	22	5	9
6	4	6	24	6	10
8	4	6	26	6	10
10	4	7	30	6	11
12	4	7	36	7	12
14	5	8	42	7	12

Select a *C*-section belt as it is a little more flexible. At 4000 ft per min this belt will transmit 12.2 hp, the same as if operated on a 12-in. sheave, as indicated in Table **X**.

Since the air compressor is to operate at 300 rpm, its sheave must have a pitch diameter of (1150x13) ÷ 300 = 49.8 in. Take 50 in. A center distance between sheaves slightly larger than the larger sheave's diameter and less than the sum of the diameters of the two will be found satisfactory for most drives, where other factors do not establish the limits. Larger or shorter center distances are practical and are recommended where required.

On high-speed drives, comparatively short center distances are recommended. In our problem the sum of the two pitch diameters is 50 + 13 = 63 in., so we may select a 60-in. center distance. This is the distance between the two shaft centers when the motor is nearest the compressor and the belts are on the sheaves and have proper tension.

Arc of Contact. Allowance must be made for the arc of contact on the small sheave. Using the same equation as for the flat belt:

$$\text{Arc of contact} = 180 - \frac{60\ (50\text{-}13)}{60}$$

$$= 143 \text{ deg}$$

Table VII gives an arc-of-contact correction factor for 140 deg of 1.20. Motor and compressor characteristics are such that they require a 1.4 service factor, Table VI. Horsepower for which the belt must be selected equals motor horsepower times arc-of-contact factor times service factor, or 50x1.2x1.4 = 84 hp. Number of belts required equal corrected horsepower divided by horsepower per belt. In this problem, 84 ÷ 12.2 = 6.88. Use 7 *C*-section belts.

V-belt length can be determined as for a flat belt, and is:

$$L = 2\text{x}60 + [1.57\text{x}(50 + 13)] + \frac{(50\text{-}13)^2}{4\text{x}60}$$

$$= 224.7 \text{ in., say } 225 \text{ in.}$$

Ordering Belts. When ordering belts it is best to select them of the nearest stock length. In this problem we have the choice of a 212- or 240-in. pitch length. If stock lengths are not known, and the motor can be set a little closer to or farther away from the driven machine, let the belt manufacturer know the amount of leeway you have and order a stock-belt length nearest to the one calculated. Then when additional belts are ordered they can be obtained directly from stock, which will insure quick delivery.

When selecting the belt it is advisable to calculate two or three combinations of sheaves and belts, to see which will have the lowest cost. In this case we could also have calculated the drive using a *D*-section belt and sheaves. When there is any doubt about the selection always consult the belt manufacturer, who will be glad to give you the benefit of his extensive experience. This is particularly true for difficult drives where a specially constructed belt may provide the most economical answer to your problem.

Leather V-Belts. Leather V-Belts have the same standard cross-sections and ratings that rubber belts have, and may be selected by the methods just described. Leather belts are generally made endless on the job, so when ordering they must be selected with sufficient length to provide for making the splice.

Here, only the general principles on which belt selection is based have been set forth, and only the simplest problems considered. The tables set up limits within which experience shows it is good practice to stay, but it may be necessary to exceed these standards. When this has to be done seek the advice of belt manufacturers' engineers. Manufacturers' catalogs, instruction books and engineering handbooks contain many useful tables not here included that everyone interested in belt applications should be familiar with. Some of the tables give belt dimensions for all conventional drives so that few or no calculations are required.

TABLE X — NORMAL HP RATINGS OF SINGLE V-BELTS AT DIFFERENT SPEEDS ON SHEAVES OF DIFFERENT DIAMETERS

Belt sections	Motor sheave pitch dia, In.	Belt Speed, Feet per Minute								
		1000	1500	2000	2500	3000	3500	4000	4500	5000
	3.0	0.7	1.0	1.3	1.5	—	—	—	—	—
	3.4	0.8	1.1	1.5	1.7	2.0	—	—	—	—
	3.8	0.9	1.3	1.5	2.0	2.2	2.5	—	—	—
A	4.2	0.9	1.4	1.8	2.1	2.4	2.7	2.8	—	—
	4.6	1.0	1.4	1.9	2.3	2.6	2.8	3.0	3.2	—
	5.0[1]	1.0	1.5	2.0	2.4	2.7	3.0	3.3	3.4	3.4
	5.0	1.3	1.8	2.4	2.8	3.2	3.4	3.5	3.6	3.3
	5.4	1.4	2.0	2.6	3.1	3.5	3.8	4.0	4.0	3.8
	5.8	1.5	2.1	2.8	3.3	3.8	4.1	4.4	4.4	4.3
B	6.2	1.6	2.3	2.9	3.5	4.0	4.4	4.7	4.8	4.7
	6.6	1.7	2.4	3.1	3.7	4.3	4.7	5.0	5.1	5.1
	7.0[1]	1.8	2.5	3.2	3.9	4.5	4.9	5.3	5.4	5.5
	8.0	2.5	3.6	4.7	5.7	6.5	7.1	—	—	—
	9.0	2.8	4.2	5.5	6.6	7.6	8.4	9.1	—	—
C	10.0	3.1	4.6	6.1	7.3	8.5	9.4	10.3	10.7	—
	11.0	3.4	5.0	6.5	8.0	9.2	10.3	11.3	11.8	12.2
	12.0[1]	3.6	5.3	7.0	8.5	9.8	11.0	12.2	12.7	13.2
	13.0	3.1	7.5	9.7	11.6	13.3	14.6	15.6	—	—
	14.0	5.6	8.2	10.7	12.9	14.4	16.5	17.8	—	—
D	15.0	6.1	9.0	11.7	14.1	16.3	18.1	19.6	20.3	—
	16.0	6.5	9.6	12.5	15.1	17.5	19.5	21.3	22.1	22.6
	17.0[1]	6.8	10.1	13.2	16.0	18.6	20.5	22.8	23.5	24.4
	20.0	8.0	11.7	15.2	18.3	20.9	23.0	24.5	—	—
	22.0	9.0	13.2	17.2	20.8	24.0	26.6	28.5	—	—
E	24.0	9.8	14.5	18.9	23.0	26.5	29.5	31.9	33.5	—
	26.0	10.5	15.6	20.3	24.7	28.6	32.0	34.7	36.7	37.9
	28.0[1]	11.1	16.5	21.6	26.3	30.5	34.2	37.2	39.5	40.9

[1]Or larger

SHORT-CENTER DRIVES

Correct tension is a must in good belt operation. If a belt is slack, not only does it slip and cause loss of power and production, but it may be burned. If it is too tight, bearings are overloaded and belt life is reduced. Formerly when most belts operated on long centers, belt elasticity contributed much to correct tension. Now most belts have short centers, and for best operation tension must be regulated automatically. Four methods of doing this use: (1) a gravity-pivoted motor base (2) a spring-tension motor base (3) an automatic tension-control base (4) an idler pulley.

Gravity-Pivoted Base. With a gravity pivoted motor base, part of the motor's weight automatically maintains tension in the belt. Such a base consists of two adjustable arms on which the motor is fastened, Fig. 1 and 2. One end of each arm is pivoted, as shown, and supported on threaded rods in the base. By turning the rods, position of the motor can be adjusted to compensate for belt stretch. Slots in the pivot arms permit positioning the motor on them.

Motor is thus positioned so its shaft center overhangs the pivot center to maintain belt tension. Fig. 1 shows the motor positioned for minimum overhang on the pivot arms to give minimum belt tension. In Fig. 2 the motor is positioned for maximum overhang and belt tension. Overhang of the motor-shaft center to left of the pivot is indicated in both figures. By locating the motor between these two positions any desired belt tension from minimum to maximum may be obtained. Overhang of the motor on the pivot shaft is an important consideration when applying gravity-pivoted motor bases. Adjust overhang to drive the peak load without noticeable belt slip.

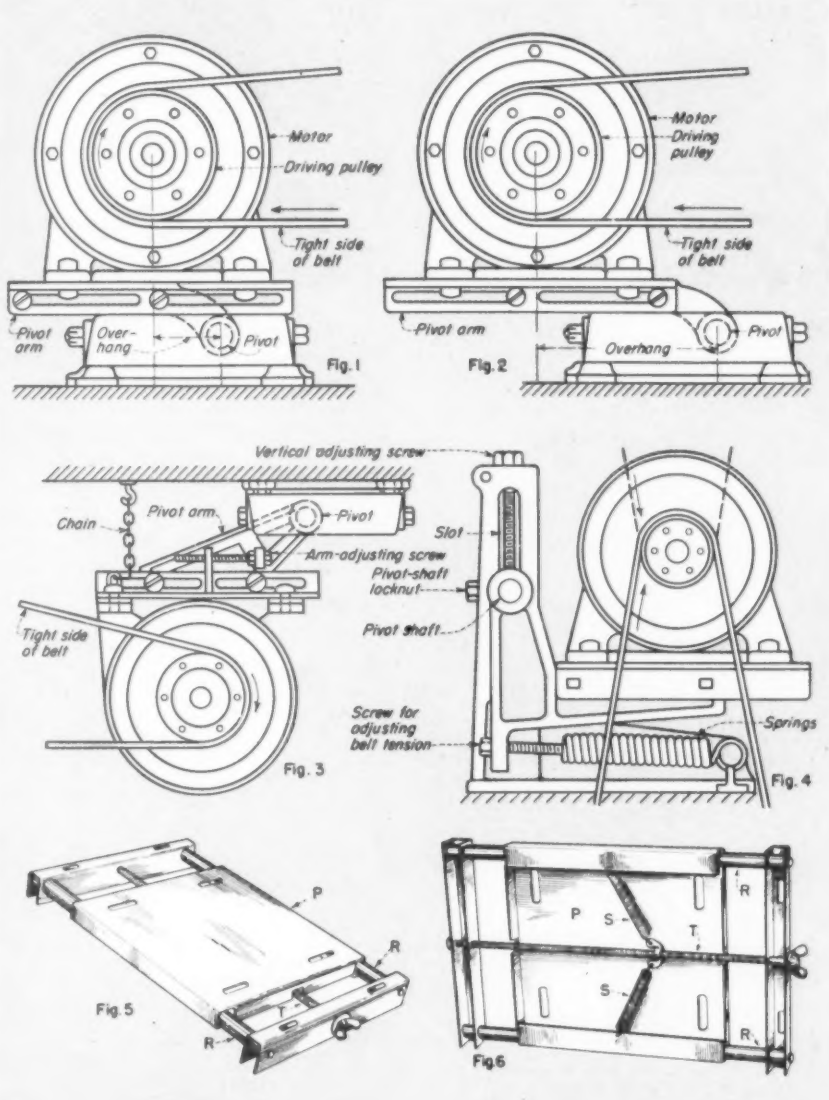
For best results have the belt's tight strand between the pulley and pivot shaft, Fig. 1 and 2. As load increases and belt stretches slightly, motor drops back because of its weight to maintain belt tension. These bases are available for mounting in any position. Those in Fig. 1 and 2 are for floor mounting. That in Fig. 3 can be mounted on the ceiling, as indicated, with the belt running at any angle from horizontal to vertical. To maintain correct belt tension this base is adjusted as are those of the floor designs.

Vertical Drives. Fig. 4 shows a pivoted motor base for vertical drives. It must always be installed with the belt's tight strand nearest the pivot shaft. Arrows indicate correct direction of belt travel. When the driven pulley is below the motor, locate the pivot shaft near the bottom of the slot, Fig. 4, so the base can be raised periodically to compensate for belt stretch. Belt tension is adjusted by tightening or loosening the screws on the springs.

When the driven pulley is above the motor locate the pivot shaft near the slot's top before installation so the base can be lowered to compensate for belt stretch. By loosening or tightening the screws in the spring ends, belt tension is increased or decreased, respectively. Adjustments are made to maintain the motor's supporting arms approximately horizontal.

Spring-Tension Base. The automatic motor base, Fig. 5, consists of a steel plate, *P*, on which the motor is mounted. This base slides on two rods, *R*, with two springs, *S*, Fig. 6, to maintain belt tension, which can be adjusted by turning screw *T*. Base ratings are for 15 hp, 1800 rpm; 7.5 hp, 900 rpm; and less.

Automatic-Tension Base. When correctly adjusted, gravity-pivoted motor bases, Fig. 1 to 4, maintain belt tension practically constant from no load to full load. This tension depends principally on the motor's weight and its



1 Pivoted motor base adjusted for minimum overhang of the motor on pivot arms. 2 Pivoted motor base adjusted for maximum overhang of motor on pivot arms. 3 Pivoted motor base for ceiling mounting. 4 Pivoted motor base for vertical drives. 5 and 6 Motor base maintains belt tension by spiral spring *S*, whose tension is adjusted by screw *T*

position on the pivot arms. The tension base, Fig. 7, utilizes the motor's reactive torque to control belt tension. With this base, belt tension automatically increases and decreases as the load increases and decreases.

A motor's stator has the same tendency to rotate that its rotor has, but in most motors the stator is fixed so only the rotor can turn. The tendency of the stator to rotate about its rotor in the opposite direction is called reactive torque, and is used to help maintain belt tension in the motor base, Fig. 7.

The motor is mounted on two slotted rails *R*, supported from the ends of cranks, pivoted in bearings *B*. This arrangement leaves the motor free to swing so that its reactive torque pushes the pulley back against the belt to increase its tension as load increases. Reduced load decreases reactive torque and belt tension. Satisfactory operation requires that the belt's tight strand be nearest the pivot, Fig. 8 to 10; otherwise belt tension would decrease with load.

Standard Motor Bases. Standard bases are used for wall and ceiling drives when the belt's tight strand is on top, Fig. 9 and 10. When wall or ceiling is not accessible for motor mounting, special top-side bases are used. These provide a floor mounting, and still keep the pivot nearest the belt's tight strand. This drive is also recommended on vertical drives, or on those within 45 deg of vertical when the driven pulley is above the driving motor.

Overhang of the pivoted motor base and offset of the reaction base depend on the angle that the drive's center line makes with the horizontal, the motor's weight, angle or belt wrap around small pulley, peak load and belt coefficient of friction. Knowing these values the overhang or offset can be calculated. To simplify this problem the American Leather Belting Association's engineering committee has worked out overhang and offset dimensions for several pulley sizes and angles of belt wrap for 1- to 60-hp motors. The Association has published these data in extensive tables, available on request from its offices, located at 41 Park Row, New York, N. Y.

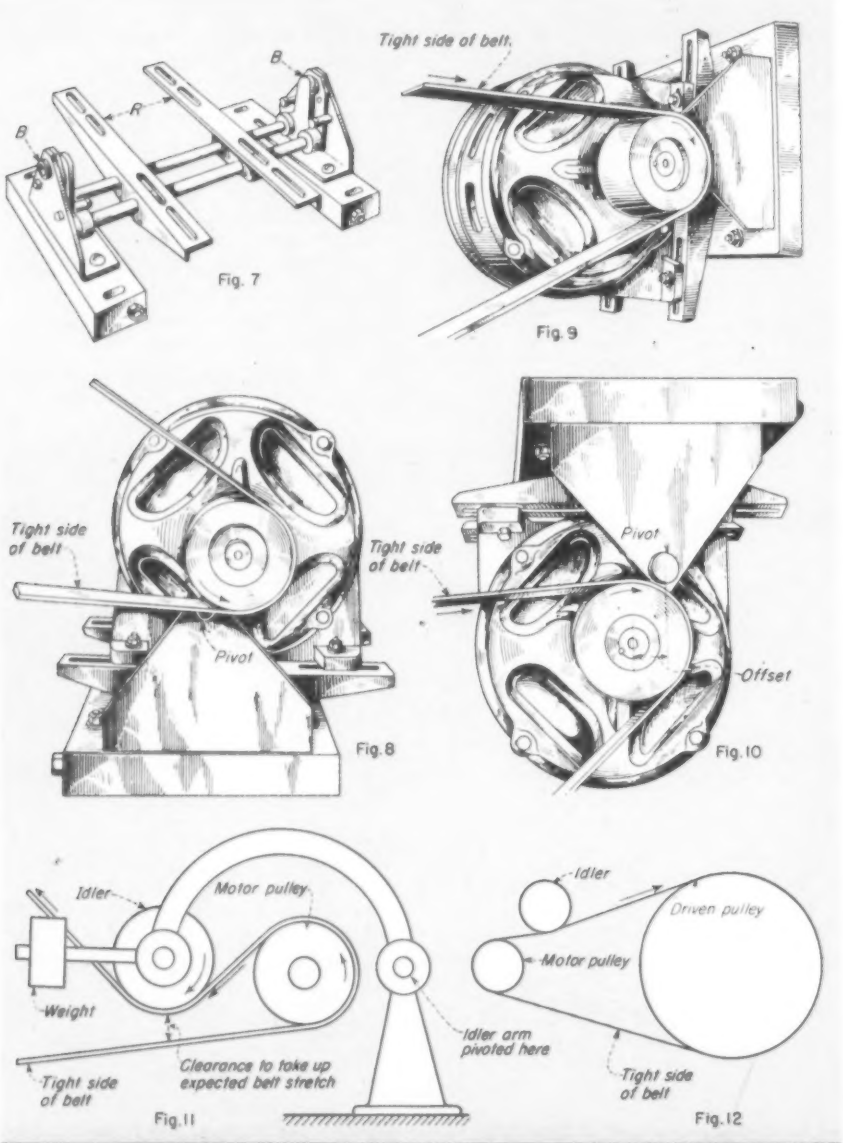
Idler Pulleys. An idler pulley provides a fourth means of obtaining automatic tension and take-up control of belts operating on fixed centers. The idler is pressed against the belt by a weight, Fig. 11, by springs, or by other means. A properly installed idler: (1) automatically maintains belt tension (2) increases angle of belt wrap around the pulleys.

Because of these actions a properly installed idler permits a belt to transmit more power for a given load on the bearings than does any other tension regulator. But the idler puts a reverse bend in the belt, which may seriously reduce its life unless the idler is properly installed, maintained and kept in correct adjustment.

Reverse Bending. Effects of reverse-bending the belt can be greatly reduced by installing an idler as large as or larger than the drive's small pulley, but without a crown. Use a belt length so it will wrap around the small pulley and support the idler with only sufficient clearance away from the bottom strand to take care of belt stretch, Fig. 11. Locate the idler so belt length between it and small pulley equals belt width. Do not use idlers on belts that operate at speeds in excess of 5000 ft per min.

When there is little slack in a belt, as in Fig. 12, an idler cannot increase belt wrap around the small pulley, and belt tension must be increased to drive the load. An idler in this position puts stresses in the belt that are several times what they would be if positioned as in Fig. 11. When the idler is installed as in Fig. 12 a sudden change in load may bounce it off the belt. When the idler falls back, the belt may be stressed to the point where it breaks. This is not the fault of the idler or of the belt, but results from their faulty installation.

Other devices have been developed to maintain belt tension automatically, but the four described are by far the most popular, and used extensively.



7 Automatic-tension-control base uses the motor's reactive torque to adjust the belt tension. 8 to 10 Tension-control bases, with motors in the three figures mounted on floor, wall and ceiling, respectively, adjust belt tension according to load. 11 Gravity floating idler. 12 Idler in the position shown puts excessive tension in the belt, which may cause it to break

BELT FASTENINGS

When flat belts cannot be made endless before installation, or when they have to be shortened, their ends must be spliced, or joined by other suitable means. Splicing is preferred, but many applications require a more convenient or easily applied method, such as lacing or joining by mechanical connectors. Because of space limitations, methods of splicing leather or rubber belts cannot be given here, but we will explain lacing procedures and applications of mechanical connectors.

Lacing a Belt. Of the many ways of lacing a belt, we will use the American Leather Belting Association's recommended practice of leather lacing. First cut the belt ends square, using a carpenter's square to insure a true cut. Carefully lay out the holes and punch them a size recommended in column 3 of Table I.

Punch an odd number of holes in belt ends, using only one row if it is less than 8-in. wide. Space holes uniformly across the belt's width. To prevent tearing, leave sufficient space between edges and end of belt, about ⅜ in. on narrow belts, and ½ in. or more on wider belts. Holding the belt, pulley side up, butt its ends together, and put the lace down through holes 3 and 8, Fig. 1. Continue to lace as indicated in Table II. When lacing is completed cut a hole with an awl, ½ in. back of holes 3 and 8, as at *N*, and pull the lacing ends through to anchor them. Cut off lace ends ¼ in. from belt's surface and slightly cut the stub end at belt. Twist and hammer down. When the job is completed, outside of lace looks like Fig. 2, and pulley side like Fig. 3. The lacing example has been worked out for five holes, but is the same for any odd number.

Two Rows of Holes. In belts 8 in. and more in width, punch two rows of holes in each end, the first row about 1 in. from the end, and the other 1¾ in. Punch the outer holes in end rows about ¾ in. from the belt's edge. Then punch the center holes and equally space the intervening ones. Punch holes in the second row, staggering them with those in the first row, as in Fig. 4. Corresponding holes in each end of the belt must be directly opposite.

To start lacing, butt the belt's ends together with their pulley side down. From the belt's pulley side, push the ends of the lace up through holes 1 and 2, drawing them together snugly, with lace's ends of equal length. Push end *A* from hole 2 down through 3 and up through 4, and continue lacing as indicated in Table III.

When first half of lacing is completed the end of the lace will be up through hole 2. With an awl, punch a hole about ½ in. back of hole 2, and pull the lace down through it. Then punch another hole about ½ in. back of the first, and pull the lace end up through it. The lace end is then treated as for the single row of holes.

The other half of the belt is laced like the first, ending and fastening the loose lace end back of hole 1. On the pulley side the completed lacing looks like that in Fig. 5. With a little practice any mechanic should be able to do a good lacing job. Belt's ends are joined with wire lacing in the same way as with leather, except the holes are made smaller.

Mechanical Fasteners. A wide variety of mechanical fasteners, such as staples, hooks, clips, clamps and plates are available for joining the ends of flat belts. These devices are sometimes called steel lacing. The simplest of these is a steel wire hook, used to join the ends of rounded belts. Holes are punched through the belt a correct distance from its ends, the hook passed through the holes, and its ends closed, Fig. 6. When the hook is correctly applied, it holds the belt ends together as shown. Terminals that thread on the ends of rounded belts and hook together, Fig. 7, are also used as connectors.

A multiple staple is one of the simplest connectors used on flat belts.

Table I—Leather Lace and Lace-Hole Sizes For Flat Belts

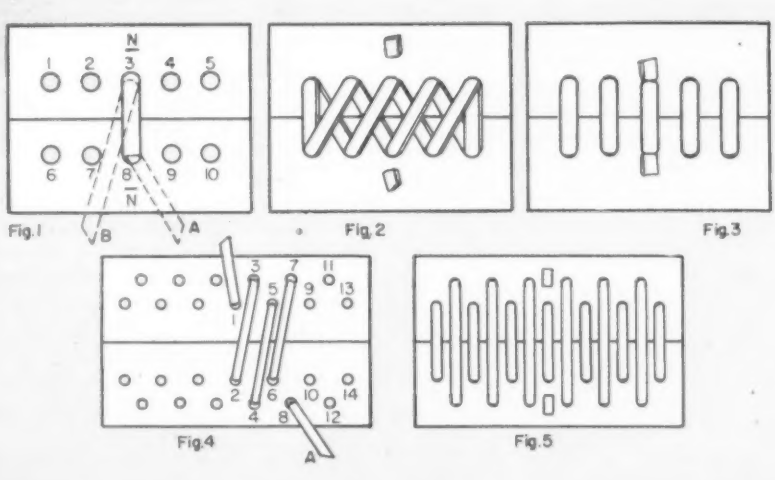
Belt width, in.	Lace width, in.	Hole diameter, in.	Number of holes
1 to 1¾	¼	3/16	3
2 to 3	5/16	¼	3
3½	5/16	¼	5
4 to 5½	⅜	5/16	5
6 to 7	⅜	5/16	7
8	⅜	5/16	13
9 to 10	½	⅜	15
12	½	⅜	17
14 and above	⅝	7/16	17

Table II — Lacing Order For Holes in Flat Belts Less Than 8 In. Wide

Put end A:		Put end B:	
Up through	Down through	Up through	Down through
3	8	7	2
4	9	6	1
5	10	6	1
5	10	7	2
4	9	8	—
3	—	—	—

Table III — Lacing Order For Holes in Flat Belts 8 In. Wide and Over

Put end A:		Put end A:	
Down through	Up through	Down through	Up through
5	6	11	12
7	8	9	10
9	10	7	8
11	12	5	6
13	14	3	4
13	14	1	2



1 Procedure for lacing flat belt in a single row of holes in each end. 2 All crossovers are on top side of belt, Fig. 1, when lacing is completed. 3 Lacing is parallel on bottom side of belt, Fig. 1, when work is completed. 4 Procedure for lacing in a double row of holes in belt ends. 5 Bottom side of belt, Fig. 4, when lacing is completed shows the lace parallel to belt

Made of steel, the staples are placed on the belt ends, as in Fig. 8, and driven through the belt, from outside to inside. After turning the belt these staples are clinched on the inside, Fig. 9. These staples are made with staggered points so they enter the belt in double rows to distribute the stress on the belt fibers.

Hook Connectors. Hooks of several designs are used widely as belt connectors. Normally made of steel wire, they can be obtained in monel and other corrosion-resisting alloys. Some hooks are made with legs of equal length, Fig. 10, so their points enter directly opposite on the belt's sides, Fig. 11. Other hooks have unequal length legs, Fig. 12, to stagger their points on opposite belt sides, Fig. 15.

These hooks are assembled on cards, properly spaced for the belt on which they are to be used. When a belt is to be laced, a section of proper length, containing hooks of the correct size for the belt, is placed in a lacing machine. With the belt's end between the hooks' points the machine sets them tightly in the belt. After the belt's other end is similarly equipped the two are joined with a rawhide pin, Fig. 13. For wet conditions bamboo pins may be used. Until installed, the belt hooks, Fig. 14, are held in assemblies by a steel binder. Like the other designs they are machine installed, but can be closed by a hammer and hand lacer.

The steel lacing, Fig. 16, is die cut in one-piece hook assemblies of lengths to suit different belt widths. Except in the smaller sizes, each hook has two prongs on each leg, as shown. When the lacing is applied, the prongs are driven through the belt from one side, and clinched on the other. The lacings are connected by a corrugated-wire, twisted rawhide, or a sectional steel-rocker hinge pin, in the same way that the belt ends are connected, Fig. 13.

The fasteners, Fig. 10 to 16, are applied without cutting any material from the belt, as is done with a punch for continuous lacing. The belt ends can be readily connected and disconnected by putting in or removing the hinge pin. The joint is also flexible because of the hinge between the belt's ends.

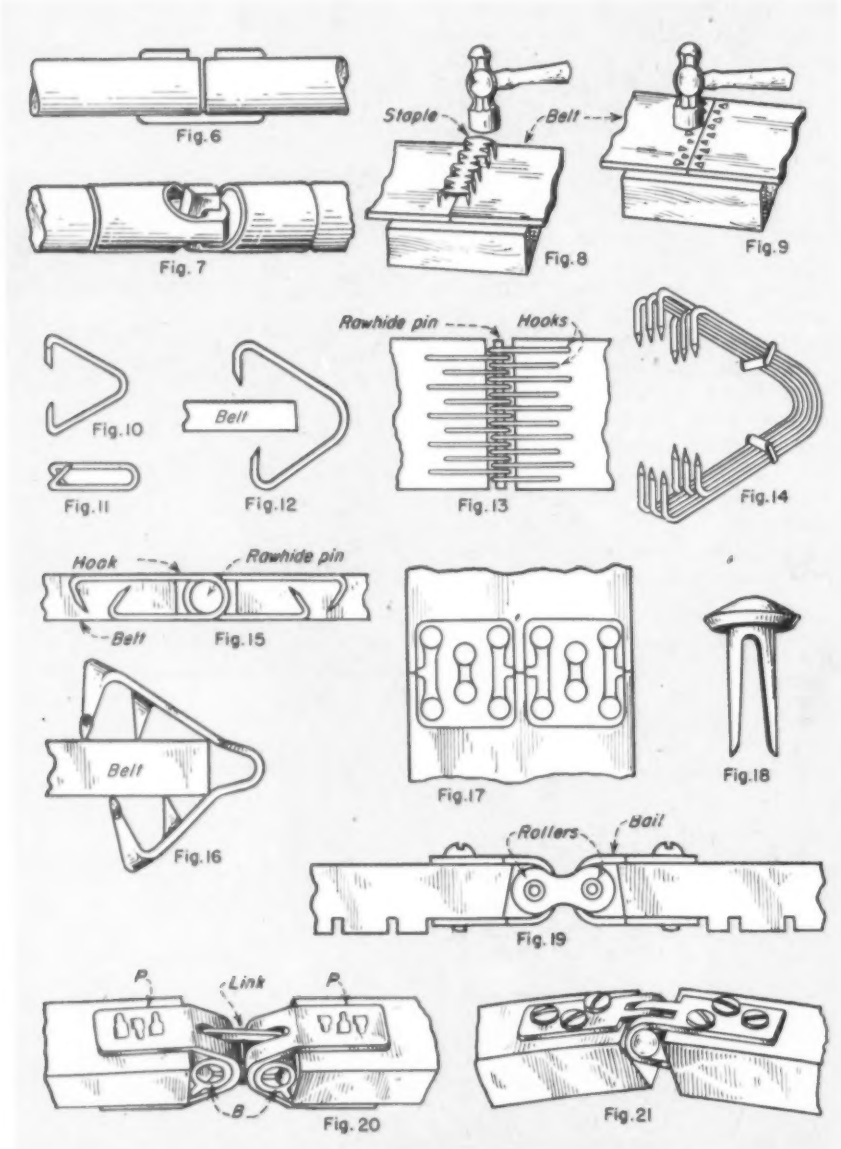
Plate fasteners in a number of designs are used to connect the ends of flat belts of all widths and weights. The design in Fig. 17 is placed outside the belt ends to be joined, and attached with split rivets, Fig. 18. After the rivets are driven home they are clinched on the other side of the belt. To prevent cutting the belt's lengthwise fibers, the rivets are driven so they spread sidewise when clinched. These plates are curved to fit the pulleys around which the belt runs.

V-Belt Fasteners. Leather V-belts can be spliced on the sheaves where they are used. Until recently all rubber V-belts were built endless because their constructions did not permit cutting and reconnecting them, even with mechanical connectors. However, specially constructed rubber V-belts are now available in long lengths that can be cut and joined on sheaves where endless belts cannot be conveniently applied. In these belts the strength members consist of multiple plies of heavy cross-woven duck, which provide adequate anchorage for the metal fasteners, Fig. 20 and 21.

The fastener, Fig. 20, consists of two formed steel end plates, *P*, two bushings, *B*, two 2-piece self-locking rocker pins, links and special nails. The nails are designed to hold the connectors on the belt's ends without weakening them or causing bulging. Bushings *B* hold the rocker pins in correct alignment to reduce friction and wear.

The connector, Fig. 21, is attached to the belt by bolts, and has two eyes in its end. These eyes, which fit together as shown, are connected by a steel pin. The fastener, Fig. 20, is used on *B*, *C* and *D* belts, and that in Fig. 21 on *A* and *B* belts. Open-end belts with connectors operate best at speed below 3000 ft. per min.

Some leather V-belts have their ends joined by a metal coupler, Fig. 19, which consists of a roller-chain link between two bails. When bolted to the belt's ends the semicircular bails act as a clevis. As the belt ends bend around the sheave the rollers ride around on the bails as they do on the sprockets of a roller-chain drive.



6 and 7 Connectors for rounded leather belt. **8 and 9** Connecting belt ends with staple-type fasteners. **10 to 16** Different arrangements of hook fasteners for connecting belt ends. **17 and 18** Plate fastener and rivet, respectively. **19** Fastener used on V-belts made of leather. **20 and 21** Fasteners that are used to connect the ends of rubber V-belts

BELT MAINTENANCE

Belt drives are comparatively simple structures, but like all machines they have a service life in proportion to the intelligence put into their selection, installation and maintenance. To insure long, troublefree service here are pointers that are easy to carry out. They apply (1) to all flat belts (2) specifically to flat leather and rubber belts (3) to rubber and leather V-belts.

FLAT BELTS. When you order belts be sure they have ample capacity for their loads and are suited to the conditions under which they must operate. Don't forget that a little excess capacity in a belt pays big dividends in increased belt life, reliability and production output, and in reduced maintenance costs.

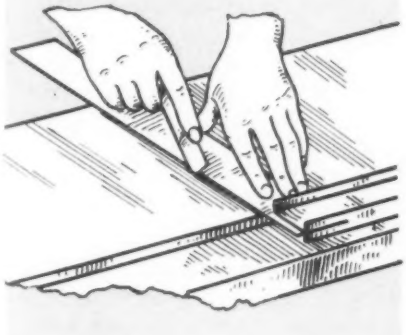
Standardize on as few belt widths and plies as will economically meet plant requirements. This forethought reduces amount of spare belting that must be kept in stock.

Belt-End Connectors. Before joining the ends of flat belts with lacing or other forms of mechanical fasteners, be sure that their ends are cut square.

Always use a steel square as a guide for the knife to make a square cut.

Don't guess at the position of the lace holes. Each hole carries a proportion of the total load and should be in correct alignment with the others.

WHEN CUTTING A BELT BEFORE YOU MAKE A SPLICE, BE SURE TO USE A STEEL SQUARE TO SERVE AS GUIDE



Provide the proper space between the ends of the belt and the nearest row of fastener or lace holes.

Holes Punched in Flat Belts. Use the belt punch sparingly, and do not use too many or too large holes, see page 89. For average conditions a No. 8, 9 or 10 punch is large enough.

An oval punch to cut lengthwise holes for lacing a flat belt is preferable to a round punch.

Remember that material taken out of a belt to attach the fasteners is just that much deducted from its strength.

Never use a knife or other bladed instrument to punch holes in a belt because these tools cut the belt fibers, and the holes are more liable to fail and pull out.

Metal Fasteners. Use proper size and type of fasteners for the belts and the pulleys they run over. The wrong size of metal fastener is a common cause of fasteners pulling out during operation.

Do not use plate or other heavy fasteners in belts that run with reverse bends or under an idler.

Renew worn fasteners before they break and damage the belt.

Watch metal fasteners in belts that run on wood or paper pulleys; they may pound and damage the surfaces of the pulleys.

Use Belt Clamps. All belts, except those 4 in. or less in width and those operating on adjustable centers, should be joined on the pulleys by pulling them together with clamps and rods before making the joint.

Apply belt clamps squarely to the belt, and remove the tension evenly by taking a turn on each nut.

Do not try to run a belt on its pulley at high speed.

Don't try to force a wide belt on its pulley, or one side may be stretched more than the other and the belt run crooked, or it may be torn.

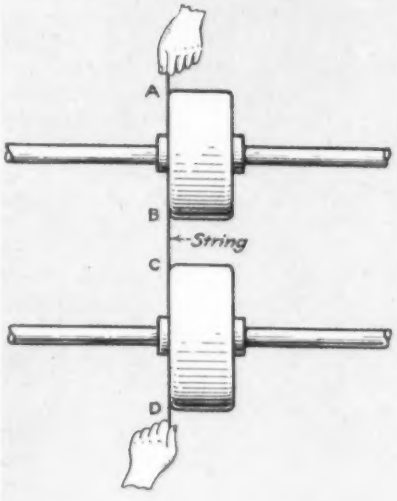
Wherever possible shorten the center distances between pulleys before attempting to run a belt on them.

Do not use undersized pulleys. They cause fasteners to pull out or fail, plies to separate, leather to crack on the outside, and laps to open up.

Do not use belts that are too thick for the drive.

Pulley Sizes and Belt Speed. Use pulleys as large as conditions permit up to sizes that give a belt speed of 5000 fpm. Up to this speed, the amount of power transmitted by a belt increases approximately in direct proportion to the size of the pulley.

IF PULLEYS ARE IN ALIGNMENT THEIR RIMS WILL TOUCH THE STRING AT FOUR POINTS, *A*, *B*, *C* AND *D*



Do not operate belts at speeds above 5000 fpm without consulting the belt manufacturer. If possible avoid such high speed.

If a belt does not run correctly on the pulleys find the cause and remove it.

Avoid excessive crowns on pulleys. They may reduce power-transmitting capacity of the belt and produce strains along its center line that will cause premature failure.

Do not run belts on flat-faced pulleys except on shifter drives.

Avoid thick, narrow belts and excessively wide, thin ones.

Use pulleys with a face ½ to 2 in. wider than the belt.

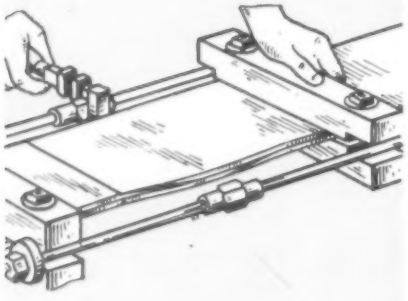
Pulley Alignment. Align shafting and pulleys so that center of belt runs true on center of pulley faces.

Poor alignment causes premature belt failure, and may give the belt a permanent crook, or cause it to run off the pulleys.

Do not operate a belt running off one side of the pulleys. Its fasteners may fail, the belt may stretch unevenly across its width, and run crooked.

Do not let belts run against station-

APPLY CLAMPS SQUARELY TO BELT AND REMOVE TENSION EVENLY BEFORE YOU START TO MAKE A SPLICE



ary objects. They will break at the edges, causing early ply separation.

Avoid vertical drives whenever possible. If they must be used, select a belt of ample capacity for the load and conditions under which it operates.

On vertical individual-motor drives mount the motor on a pivoted base.

Idler Pulley Drives. Avoid idlers if it is possible; they will put a reverse bend in the belt.

If you must use an idler (1) use an approved unit, according to recommended practice, and (2) apply it to the slack side of the belt whenever possible.

Do not use crowned idler pulleys. They put a reverse bend in the belt across its width, which may cause ply separation, or failure of cemented joints and fasteners.

Check idler-pulley alignment.

Avoid worn idler-pulley bearings. They often cause flat belts to weave when they are running.

Do not use idlers that bounce off and fall back on the belt. Belts have been broken in two by this action.

Avoid idlers on short-center individual-motor drives by mounting the motor on a pivoted or automatic-tension base. In practice belt tension is usually determined by trial, except with a pivoted motor or automatic-tension base. For these types, tension can be calculated.

Where possible operate belts with the slack side on top. This allows the belt to sag and in this way increase the arc of its contact with the pulleys.

Belt Shifters. Avoid shifters that do not throw the belt entirely off or on the loose pulley. Otherwise, one side of the belt will be stretched more than the other, and it will run crooked.

Make sure that belt shifters are not abusing the belt, causing its edges to curl and plies to open, or producing other effects harmful to belts.

To reduce edge wear on the belt, use shifters with (1) broad-surfaced sides and rounded corners and (2) antifriction bearings in their sides.

Be sure that loose-pulley bearings are well lubricated.

Install cross belts so points of laps at the position of the cross do not run against each other and open.

Always make quarter-turn belts endless on their pulleys.

Flanged Pulleys. Always keep belts in good alignment on flanged and on stepped-cone pulleys.

Just because flanges prevent the belt from coming off the pulleys do not neglect to maintain good alignment. Otherwise, the belt may wear itself out on the flanges.

On stepped-cone and flanged pulleys, use the heaviest belt possible consistent with pulley diameter.

On flanged or stepped-cone pulleys use a belt with (1) rounded edges and (2) width of ⅜ to ½ in. less than pulley-face width.

Do not use a fillet in the corner between the flange and face of a flanged pulley. It tends to cause the belt sides to climb the flanges.

Cut reverse fillets in the corners between the flanges and pulley face, so the belt edge runs into it, and prevents the belt from climbing the flanges.

Proper Belt Tension. Operate belts with the minimum tension that prevents slipping. A properly installed, aligned and operated leather or rubber belt should run a long time before shortening is necessary.

Do not operate a belt that is too loose. It will slip excessively, and the frictional heat created will burn and crack its surface. A belt should not creep and slip more than 2%.

Check belt slip and creep with speed counter and pulley ratios.

Do not operate a belt that is too tight. It will crack on the outside and fail prematurely; in addition, it may overheat the shaft bearings.

Never order a new belt from the length of an old one.

When measuring belt length, use steel tape around pulleys, deduct ⅛ in. per foot from this length and add length of splice.

Where excessive tension is required to prevent slipping, substituting a wood or fiber pulley for the small steel one may give relief.

Lagging the small pulley with leather, rubber or duck may also permit carrying the load with reduced tension. Several plies of duck may be cemented on the pulley with good rubber cement.

On individual-motor drives, mounting the motor on a pivoted or automatic-tension base permits operating at reduced tension in the belt. Where such a base cannot be used, a properly selected and installed idler may solve the problem.

Adverse Operating Conditions. Recrown fiber and wood pulleys when they wear down.

Keep all obstructions away from the belt's sides. This prevents rubbing if it runs off one side of the pulleys.

Don't let objects fall on or against a belt; they may cause serious harm. A heavy 12-in. double-leather belt requires a load of 16,000 lb to break it under a straight pull, but only 200-lb fouling the belt may tear it.

Keep both belt and pulleys clean.

Take care to prevent lubricating oil from the bearings or other sources from getting on belts.

Keep records of belt performance, and study them for causes of unsatisfactory service.

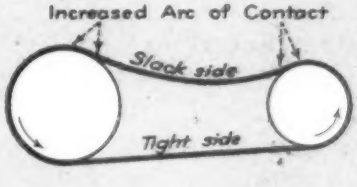
Watch for and correct adverse operating conditions before they have time to cause excessive wear or complete belt failure.

Do not overload a belt and still expect good service.

Do not operate belts exposed to the weather or excessive heat, if these adverse conditions can be avoided.

Don't operate belts in the presence of acid fumes or excessive moisture without first getting the manufactur-

WHERE POSSIBLE, OPERATE BELTS WITH SLACK SIDE ON TOP TO INCREASE THE ARC OF THEIR CONTACT



er's recommendations in the matter.

Establish a schedule for belt inspection at specified intervals.

Make one man responsible for lubricating motor and shaft bearings, and for maintaining proper tension in the belts; he can then be held responsible for any failures that might occur.

FLAT LEATHER BELTS. Always operate leather belts with grain or hair side on pulleys.

Run leather belts so the feather edge of laps on the outside points away from the pulley as the laps approach it.

Use endless belts wherever possible, made endless with a high-grade waterproof leather cement. Improper cementing may let the belt open at the endless joint.

Making a Belt Endless. Before cementing an old belt, remove grease from the leather by soaking its ends for about 30 minutes in a solvent, made of 25% carbon-tetrachloride and 75% gasoline.

Be sure that a belt is properly squared and that it is lined up before making an endless splice.

Never use homemade adhesive for cementing a belt.

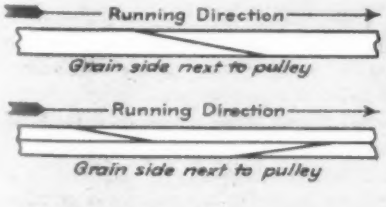
Always take tension from lap section of belt before making a cemented splice.

Inspect joints in belts periodically and repair them, by cementing with waterproof cement, at the first sign that laps are opening up at their ends.

Do not try to fix cemented joints with rivets or lacing; re-cement them.

Use Belt Dressing. Clean and dress belts with a good belt dressing every six months for the first year, and at 3-month intervals thereafter.

RUN LEATHER BELTS SO THAT THEIR LAPS WILL BE POINTING AWAY FROM THE BELT'S RUNNING DIRECTION



Dress single-oak belts on the flesh side because the dressing penetrates more thoroughly through that side than through the grain.

When pulley surfaces begin to get glossy it is an indication that the belt is in need of some dressing.

Prevent oil or water from dropping on a leather belt.

Where belts are subjected to frequent splashing with mineral oil that cannot be avoided, treat the belt with an oil or waterproof dressing.

Before applying dressing clean the belt with the 25% carbon-tetrachloride, 75% gasoline solvent previously mentioned to remove excess oil.

When cleaning a belt, elbow grease applied with a scrubbing brush does a lot of good.

If oil must be removed from a belt while it is running, use powdered chalk; then clean off the powdered chalk after it has absorbed the oil.

Dress double-oak belts on both sides, because cement between plies resists penetration of the dressing.

Before dressing a belt, be sure it is thoroughly clean. If necessary, scrape the belt to remove the dirt.

With a rag or brush apply dressing over the entire belt surface.

Do not overdress belts; use only enough dressing to produce the results that are desired.

Do not use resin or other sticky belt dressings. They tend to cake, and build up lumps, on belt and pulleys, that subject the belt to stresses which might prove disastrous.

Put Belt in Storage. Do not let the belt stand for a long time under tension on the pulleys.

When machines are to be shut down for a long time, remove leather belts from the pulleys. Clean off all foreign matter with a brush or scraper. Recement any laps or edges that are loose and replace worn sections. When cement is dry use a good dressing recommended by the belt manufacturer. Apply with a brush or rag to both sides of the belt; then roll, tie and tag the belt for the drive to which it belongs.

Store belts after treatment in a clean, cool, dry place.

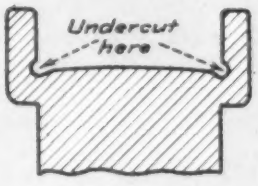
Two weeks before putting belts into service take them out of storage and give them an application of dressing.

FLAT RUBBER BELTS. Modern rubber belts are highly antioxidant and have resistance to aging, but if stored keep in a cool, dark place away from sunlight, heating pipes, oil, excessive moisture and corrosive fumes.

Use endless belts wherever possible.

Do not use undersized pulleys. They cause fasteners to pull out or fail;

CUT REVERSE FILLETS IN CORNERS BETWEEN FLANGES AND PULLEY FACE TO PREVENT THE BELT CLIMBING



"bootlegging," blistering, ply separation or air pockets may occur in the belt when it is in operation.

When folded belts are used it is preferable to run them with the seam on the outside except where the pulleys have excessive crown.

Avoid excessive crown on pulleys. It may produce strains along the center line of the belt that will cause premature failure of the fasteners and ply separation.

Do not use crowned idler pulleys because they put a reverse bend in the belt across its width, which may cause ply separation, blistering and fastener failure.

If a new rubber belt slips, the trouble is sometimes corrected by washing the white powder coating from the surface in contact with the pulley.

Use Dressing Sparingly. Dress the belt sparingly and only when actually needed.

When a dressing is needed to remove the glaze on a rubber belt's pulley surface and to soften this surface slightly so it makes better contact, use a light application of vegetable castor oil applied uniformly with a cloth.

Excessive applications of oily dressing act as a lubricant and increase belt slipping on the pulleys.

Do not use resin or other sticky belt dressings. They tend to cake and build up lumps on the belt and pulleys that subject the belt to stresses that may prove disastrous.

Keep both belt and pulleys clean.

Avoid Oil on Belt. Keep lubricating oil from bearings or other sources from getting on rubber belts. In time oil

destroys the belt structure, causing it to stretch unevenly and run crooked, and its fasteners to pull out. Even vegetable castor oil, if applied too frequently, softens the surface of the rubber to a point where it wears off faster than normal, and shortens belt life.

When rubber belts must be operated in the presence of mineral oil use synthetic rubber designs that are highly resistant to oil.

For high-temperature applications use belts made of synthetic-rubber.

RUBBER V-BELTS. Store V-belts in a dark, cool place. Use a sufficient number of correct size belts to handle the maximum load without excessive tension.

Don't use undersize sheaves; they require excessive tension in the belts, cause undue bending stresses and overheating, and break down the belts' structure.

Use matched sets of multiple rubber V-belts.

Provide sufficient take-up so the belts do not have to be discarded before they are worn out.

Belts and Sheaves. Make sure that belts and sheave grooves match. Grooves that are too small cause belts to ride too high. If too large, they cause them to ride too low.

Use standard belts and sheaves to make it easier to get replacements.

Don't operate V-belts at speeds above 5000 fpm if it can be avoided. If it can't be avoided, consult the manufacturer for recommendations.

Use sheaves as large as conditions permit up to sizes that give a speed of 5000 fpm. The amount of power transmitted by the belt increases in approximately direct proportion to sheave pitch diameter.

Keep shafting and sheaves in good alignment. Poor alignment puts uneven tension in the belts and causes excessive side wear on both the belts and the sheave grooves.

Do not let belts run against fixed objects as they will wear the belts' sides and tear them.

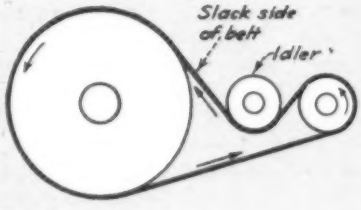
Belt Installation. Avoid vertical drives whenever possible, but if they must be used, have an ample number of belts for the load and conditions under which they must operate.

On vertical individual motor drives mount the motor on an automatic tension or a pivoted base.

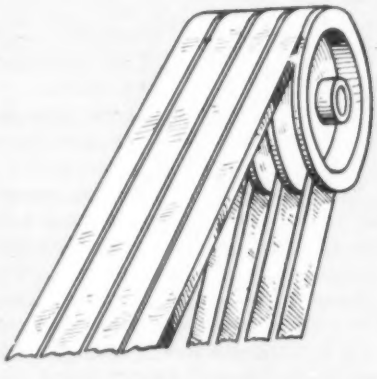
When possible, operate the drive with the slack strands of the belts on the top side.

Under severe operating conditions, where drives are operated with the slack in the bottom strands, a properly applied idler to reverse the slack-side sag in the belts will improve the drive.

DO NOT USE CROWNED IDLERS. THEY REVERSE-BEND THE BELT, AND TEND TO CAUSE PLIES TO SEPARATE



USE SHEAVE AS LARGE AS CONDITIONS WILL PERMIT UP TO SIZES THAT GIVE A 5000-FPM BELT SPEED



Do not use an idler to put tension in the belts.

Operate the belts with the minimum of tension that will drive the load without causing the belts to slip.

After belts are installed, a few days are required for proper seating into the sheave grooves; then they tend to get slack. This slack will have to be taken out by adjusting the center distance between the sheaves. After this a properly designed V-belt drive should operate for several months without any further adjustment being necessary.

Belt Tension. Don't operate V-belts too tight because they will wedge down into the sheave grooves. Their efficiency and life will be reduced, and unnecessary internal heating of the belt will result.

On individual motor drives where more than normal tension is required in the belts to prevent slipping, mount the motor on an automatic tension or a pivoted base.

Keep Belts Clean. Lubricating oil from bearings and other sources should be kept off the belts. In time oil destroys the rubber and lets the belts collapse.

Use synthetic-rubber belts when they must operate in the presence of mineral oil.

Don't operate V-belts in acid fumes or excessive moisture without first getting the manufacturer's recommendations for these conditions.

Keep V-belts and sheave grooves clean and free from harmful burrs and see that they are not unduly worn and that groove corners are not sharp.

Don't leave tools or other objects where they can fall and possibly injure or break the belts.

Don't operate V-belts exposed to the weather, direct sunlight, or in temperatures in excess of 130 F if these conditions can be avoided.

Use synthetic-rubber belts for temperatures above 130 F or operations in direct sunlight.

Belt Replacements. When belts become worn, replace the entire set of belts, not just a single belt.

Don't use a bar to pry V-belts on their sheaves. The bar may rupture the belt structure and cause short life.

Run motor far enough forward on its guide rails so that the belts have sufficient slack to slide easily over the small sheave when putting on or taking off V-belts.

Replace belts when they become worn before they bottom in the sheave grooves.

Don't use belt dressing on V-belts.

Remove the belts and store them in a cool, dry place when the drive is to be out of service for some time, and coat the sheaves with grease to prevent rusting. Clean the sheaves of all traces of grease before replacing the belts.

LEATHER V-BELTS. Excepting items that apply only to rubber maintenance, suggestions given for rubber V-belts are correct practice for leather belts of the same cross-section. Also, in the flat leather-belt section, recommendations that apply specifically to leather hold for V construction. So a study of the flat leather and V-belt sections will give a comprehensive schedule for leather V-belt maintenance.

LEROY R GUTHRIE: A POWER PERSONALITY

This many-sided chief supervises operation and power distribution, besides planning modernization, helping his men build careers

Leroy R Guthrie believes there is no substitute for on-the-spot inspection of his power plant and its personnel

▶ LEROY R GUTHRIE, chief engineer of the power plant of the Weyerhaeuser Timber Co, at Longview, Washington, supervises supply of the all-essential power services to one of the world's largest lumbering operations. The Longview Branch is located on the banks of the Columbia River, where the plant produces lumber, the many byproducts now derived from it in scientific forest-products operations, and paper pulp of high quality. A new kraft mill and a plywood plant will add considerably to the size of these already large operations and to the responsibilities of the engineer who takes care of their myriad power needs.

The power plant under Guthrie's watchful eye is one of the largest in the forest-products industries; boilers, with a total capacity in excess of 600,000 lb per hr of steam at 335 psi and 580 F, supply a turbine room having a total capacity of 26,000 kva. Of this capacity, 19,750 kva consists of two extraction-condensing units, and the remaining 6250 kva comprises a backpressure unit. A separate pumphouse on the river bank furnishes some 45,000 gpm of water. The combined plant supplies electrical energy, steam, water and compressed air to both the lumber and pulp divisions.

Supervising the operation of this plant and the distribution of the power services takes a large part of Guthrie's time, but he manages to reserve a corner of his keen engineering mind for investigating improvements and for planning. Since coming to Longview in 1931 as assistant chief, and particularly since he became chief in 1943, he has been responsible for much of the modernization of the original plant.

MERCHANT MARINE INSTILLS SELF-RELIANCE

Like many other topnotch power engineers, Guthrie served a hitch at sea and holds a chief's license. Being responsible for unfailing power in an engine room miles from nowhere and with no one to call on for advice or assistance seems to breed self-reliant engineers, able to cope with any emergency. Although it's now a long way in the past, Guthrie agrees that his three years in the merchant marine were invaluable as engineering experience.

The trick at sea came about like this: Guthrie completed mechanical engineering studies at Oregon State College in 1918, just in time to join the World War I Navy. When he came out of the Navy's transport service in 1919 as an ensign, he promptly tackled three years in the merchant marine. That led to the chief's rating.

Back on shore, Guthrie spent two years in Washington, D. C., working in the automotive and aeronautic power plant section of the Bureau of Standards. A year of teaching followed, at his alma mater, Oregon State College, in the School of Engineering. That was 1924, and Guthrie was about to swing into the field of engineering—his specialty from then on: He went to Pittsburgh to work in The Duquesne Light Co's Colfax and Stanwix plants.

In 1928, Guthrie came back to the West Coast, his father's health being the immediate reason. Still hewing to the powerplant line, he began with the Northwestern Electric Co, but in the fall of 1929 switched over to the Portland Electric Power Co, where he played an active part in the layout and construction of a new 35,000-kw unit. Fresh from this experience he went to Longview in 1931.

Guthrie delights in chess as a hobby. Here he gets the same deep satisfaction from studying and solving a knotty problem that he does from the engineering that forms his everyday work.

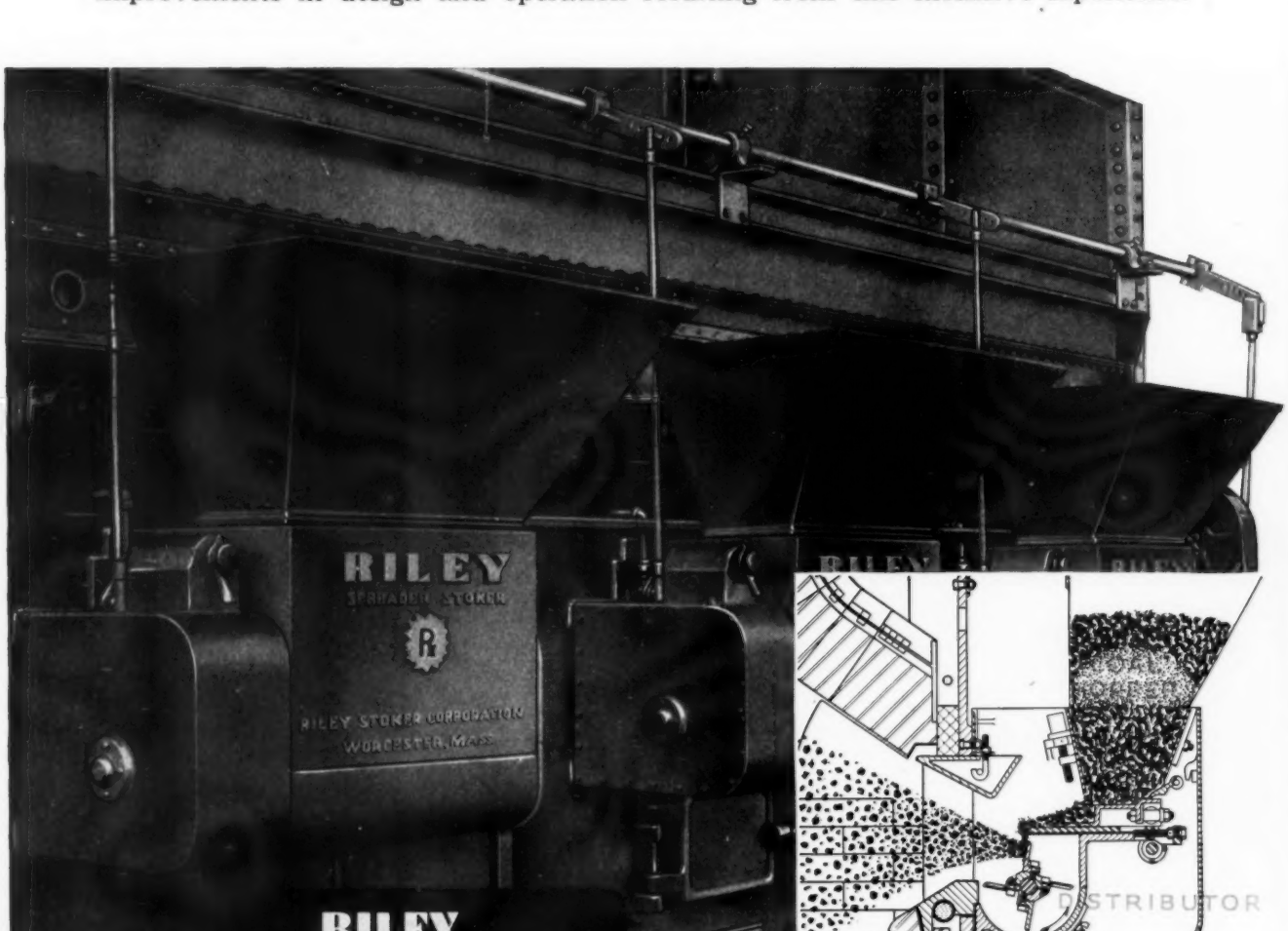
His all-absorbing hobby, however, is being a dad to his two sons, one a junior in high school, the other in sixth grade. Headquarters for this hobby on weekends and vacations is a cabin on the picturesque Toutle River, 15 miles north of Longview. The family fishes and roughs it in country where it is easy to get close to nature. It's been hard work, Guthrie declares, clearing their land and building the cabin, but every minute of it was fun and worth while.

On the job, Guthrie keeps a finger steadily on the pulse of his plant by the personal on-the-spot inspections for which there is no substitute. He is a firm believer in the wisdom of building the strength of his organization by building the ability and knowledge of the individuals composing it. He has put this belief into action by taking a strong part in the company's training program to educate young men in powerhouse practice and procedure.

Investigate the new improved

Backed by over 50 years of Stoker Experience

The stoker engineering experience of the Riley Stoker Corporation dates back well over fifty years to the Murphy Furnace and the Jones Underfeed Stoker, two of the first commercially successful stokers. Riley has maintained this position of leadership in coal firing equipment. The Riley Spreader Stoker embodies many improvements in design and operation resulting from this extensive experience.



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STOKER CORPORATION, WORCESTER, MASS.

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It will pay you to visit modern Riley Installatio

RILEY SPREADER STOKER

with these distinctive advantages

1 Ability to burn low grade coals

The Riley Spreader Stoker efficiently burns fine sizes of the high moisture high ash bituminous and semi-bituminous coals as well as lignite.

2 Will efficiently burn wide range of coals

The Riley Spreader Stoker will not only efficiently burn low grade coals but will also burn the higher grade eastern coals at high efficiency, so that users are at liberty to purchase coal on a price basis.

3 High efficiency

High combusion efficiency is obtained because the fine particles are burned in suspension and the coarse particles are uniformly distributed over the grate surface, where they are burned without agitation and with a minimum of clinker formation.

4 Overrunning distributor

An overrunning coal distributor together with an adjustable feeder plate provides uniform distribution of coal from front to rear of the grate.

5 Adjustable distributor blades

By adjusting the angularity of the distributor blades, uniform lateral coal distribution is obtained. The combination of overrunning distributor and adjustable distributor blades assures uniform coal distribution.

6 Positive uniform feed

A reciprocating rapidly moving plunger and the design of hopper affords a positive uniform feed preventing furnace pulsations.

7 Low maintenance

The feeder driving mechanism is simple, totally enclosed and splash lubricated. Grates are air-cooled and protected by a layer of ash. Not only low maintenance but complete reliability results.

8 Silent enclosed driving mechanism

The feeder is actuated by a rugged simple eccentric mechanism, splash lubricated and totally enclosed in a dust-tight housing. Operation is silent and positive.

9 Feeder housing water-cooled

The feeder housing is water-cooled to minimize heat absorbed by the furnace. Water cooling prevents heat distortion of the driving mechanism and overheating of lubricants.

10 Removable aluminum housing covers

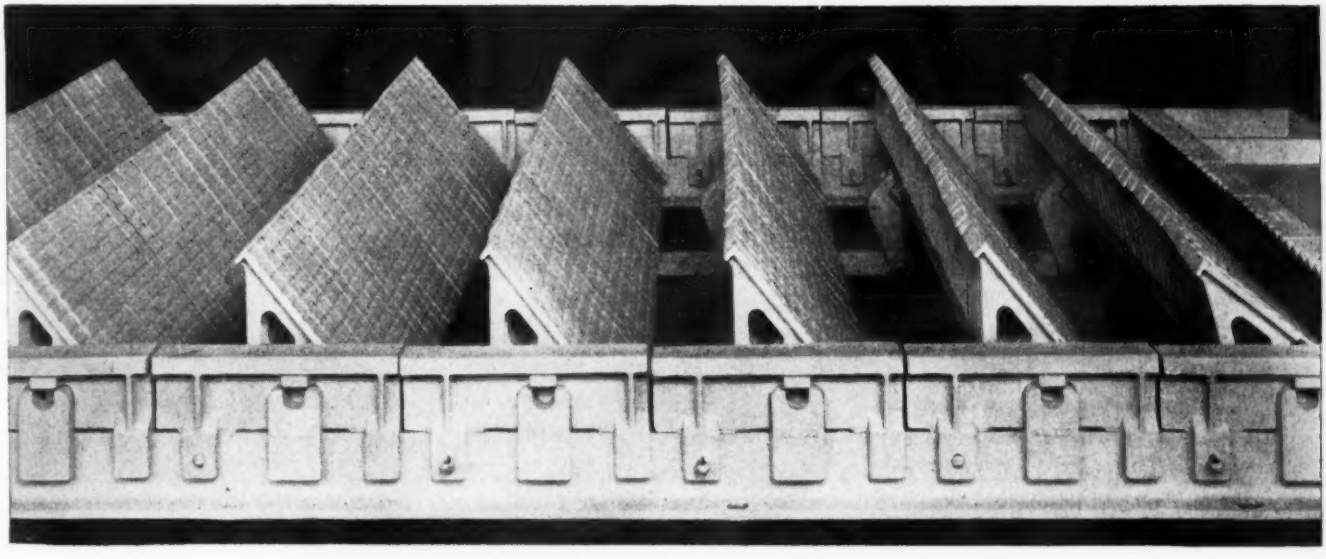
The housing front cover and sifting tray are of cast aluminum, are easily handled by one person and readily removable.

11 Accessible safety shear pin

A safety shear pin is located in each feeder drive shaft sprocket where it is readily accessible for replacement.

12 All feeder parts accessible from front

Complete accessibility to all feeder parts is obtained from the front of the stoker through easily removable covers.



RILEY SPREADER STOKER DUMPING GRATE

Riley Spreader Stokers can be supplied with travelling grates, dumping grates or stationary grates

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR-HEATERS

efore purchasing Boiler or Fuel Burning Equipment

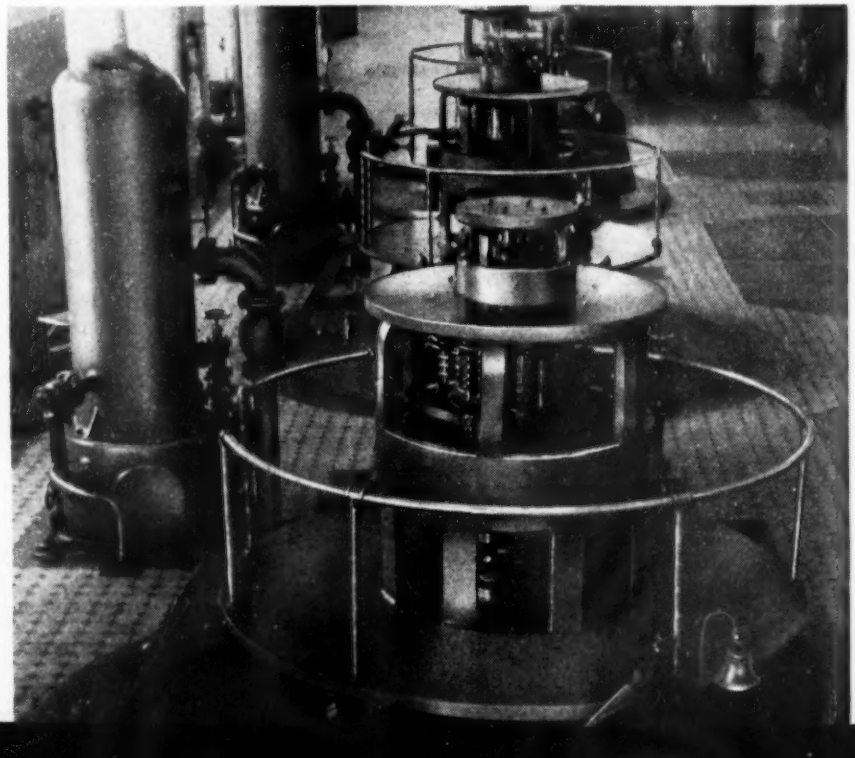
Kanaker hydro plant, high in the mountains of Armenia, is one of eight plants to be built along the Zanga River. Water for these plants will be obtained by lowering Lake Sevan's level about 175 ft to reduce evaporation

USSR Cuts Lake's Evaporation to Increase Hydro-Power Generation

▶ WHEN SOVIET ENGINEERS needed more water for hydroelectric-power generation and irrigation they decided to lower a lake's level to reduce evaporation. When the project is completed. the water, instead of escaping as vapor from the lake's surface, will flow down the Zanga River to be harnessed for useful purposes.

Lake Sevan is 37 miles from Yerevan. capital of Soviet Armenia. It has an area of 600 sq mi, and is 7000 ft above sea level. Of the large inflow into the lake at present, very little water flows out because of the high rate of evaporation from the lake's large surface. The project now under way will lower the lake's level about 175 ft, and thus reduce its area to where evaporation will be comparatively small. The added water will be used in eight hydroelectric plants, utilizing a total head of 3300 ft, and in irrigation of 175,000 acres of arid land.

Kanaker station, first of these hydro plants to be built, is on the fifth level below the lake, and supplies power to industrial plants around Yerevan. This plant has four 15,000-hp units in operation. The highest-level plant is now being constructed, and work will start soon on Gyumush station. Largest of the eight to be built, Gyumush will have double the capacity of Kanaker plant.



Operating floor shows the exciters and governor pressure tanks in Kanaker's 60,000-hp hydroelectric plant, which is on Zanga River in Soviet Armenia

INDUSTRY-WIDE BARGAINING...

Death Trap for Business, Suicide for Free Labor

IF CONGRESS is to succeed in its present efforts to prevent strikes in key industries from devastating the nation, it will have to put a crimp in industry-wide collective bargaining. This kind of bargaining is designed to apply agreements between employers and organized workers on wages and working conditions to an entire industry.

Further, if extension of this type of bargaining is not curbed, there is reason to believe that it will undermine the freedom of both American business enterprise and American wage earners. For, while increasing the destructive power of labor disputes, the general spread of industry-wide bargaining would so concentrate the fixing of wages—by far the largest element in the cost of production—that government regulation would be a next short step. With that step taken, freedom for business enterprise and freedom for labor would be well on the way out.

Unfortunately, industry-wide bargaining is commonly regarded as presenting a general conflict between organized labor and employers, with unions favoring it and employers opposed to it. This mistaken notion raises the heat of much of the discussion without increasing the light. The fact is there is no such general conflict. Employers and organized workers are on both sides of the argument about industry-wide collective bargaining. For example, while some union leaders are characterizing as labor baiters all those who raise the slightest question as to the desirability of industry-wide bargaining, organized workers in the air transport industry are strenuously opposing that type of bargaining; and the employers are advocating it.

Some Employers Like It

The reason there is in fact no clear cut issue between employers and unions over industry-wide bargaining is readily understandable. It presents certain advantages to both sides in the bargaining process. For example, union advocates of such bargaining generally stress the fact that industry-wide agreement on wages protects wage standards from being undercut by lower wage areas and lower wage employers. By much the same token, however, employers who like it often emphasize the fact that industry-wide bargaining may save certain well-managed and prosperous companies from being singled out for particularly heavy wage exactions. This general point has been underlined in both the full-fashioned hosiery industry and the West Coast paper and pulp industry. There, local unions, affiliated with international unions, have protested that industry-wide collective bargaining prevents them from getting from especially prosperous employers wages as high as they could get if allowed to go it alone in collective bargaining.

So long as employers remain subject to the federal antitrust laws while unions are exempted, the balance of power in industry-wide bargaining would seem to be heavily weighted on the side of the unions. If, for example, employers were to announce an intention to match an industry-wide wage increase by an industry-wide price increase, there is no doubt that they would promptly be indicted for violation of the federal antitrust laws. Even so, the fact remains that some employers favor industry-wide bargaining while some segments of organized labor are against it.

A Clear Cut Public Issue

The industry-wide bargaining issue as it affects the public, however, is clear cut. It is concentration of economic power (in the hands of both unions and management) which can make industrial conflict devastating to the public welfare. At least five times within about a year—in steel, on the railroads, in the maritime industry and twice in the soft coal industry—strikes prompted by union efforts to impose industry-wide agreement about wages and working conditions have paralyzed large parts of the nation's economic life.

In soft coal about 90% of the production workers are members of the United Mine Workers. In steel

about 80% of the production workers are members of the United Steelworkers, C. I. O. In some other key industries there is a comparable degree of concentration of union control. In the face of such concentration many employers see no alternative but to get together on their side for industry-wide bargaining. But when they do so in key industries, the odds are lengthened that failure to agree on wages and related matters, will result in generally ruinous conflict. If agreement is reached, the chances are increased that it will take too little account of the welfare of the consuming public.

It is possible to have industry-wide bargaining on many subjects other than wages. *But the main interest is wages; and the main drive is toward industry-wide and ultimately nation-wide uniformity. Such uniformity is the deadly enemy of industrial decentralization and the pioneering expansion of industry in new areas.* Why pioneer, with inexperienced workers, if the wage rate must be uniform for the whole industry? Moreover, it would also be hard to conceive of a more effective way to put a blight on local efforts to improve industrial relations than to make wage rates and other working conditions uniform throughout the industry and then the nation. *However, among many other dangers, the overshadowing danger in industry-wide bargaining lies in its concentration of economic power.*

Wages Monopolized

On the average, the cost of labor accounts for about two-thirds of the total cost of all industrial products. The universal spread of industry-wide bargaining would thus concentrate in relatively few hands control of the greater part of the cost of industrial production. There is no reason to believe that even without disastrous strikes, such concentration would long continue free from government regulation. That would turn more earth for the graves of American business enterprise and American working men's freedom.

Those who believe that industry-wide bargaining serves the public well—and many sincere people do—stress the fact that, on the whole, it has worked in the industries where it has been tried over a considerable period. Most of the industries of which this is true, however, are not key industries. The pottery industry, the glassware industry, and the silk and rayon dyeing industry—to cite a few in which industry-wide bargaining has been practiced with considerable success—are important industries. But they are not industries in which strikes would have a ruinous impact on the nation. In contrast, a strike in the soft coal industry as the result of a breakdown of industry-wide negotiations quickly becomes a national disaster. The dangers inherent in industry-wide bargaining are multiplied accordingly.

England No Guide

Those who think extension of industry-wide bargaining would be good for the public often emphasize the fact that it has worked smoothly in England, where it has been extensively practiced. *Not the least of the things it has smoothed in England, however, is the transfer from private enterprise to state socialism of industries in which industry-wide bargaining by monopolistic unions and employer groups had so badly undercut competition that private enterprise had lost much of its justification.* A general extension of industry-wide bargaining could be expected to have the same consequences in this country.

The best way to curb industry-wide bargaining is a question which lies beyond this discussion. *Much would be accomplished if the federal government would discontinue its active promotion of industry-wide adjustments, in the fields of both labor and management, at which it has been busy ever since N. R. A. days. Still more would be accomplished if the federal antitrust laws were applied with even-handed justice both to unions and employers—a course urged in the 53rd editorial in this series.* Perhaps a definite limitation of the scope of labor agreements would also be necessary.

The effects of industry-wide bargaining in increasing the extent of public regulation of industry will vary. They will, of course, be less pronounced in railroads and other public utilities, which are already extensively regulated, than they will be elsewhere. For unregulated industries, however, industry-wide bargaining carries the threat of extensive regulation and, along the way, of industrial conflict devastating to the public. In these excited times, to say what I have said here is to invite characterization by overheated partizans as a foe of legitimate union progress. That is perhaps not so bad, however, as to qualify as a pall bearer for both American business enterprise and some of the basic freedoms of American working men. That may well be the fate of those who blindly accept the expansion of industry-wide collective bargaining as being "in tune with the times."

President McGraw-Hill Publishing Company, Inc.

THIS IS THE 55TH OF A SERIES

How to Design and Erect A Stable Compressor Foundation

Follow the suggestions given here and the foundation you build will not settle, tilt or slide. Instead, it will absorb unbalanced vibrating forces so compressor will operate quietly and will not shake other adjacent equipment

By GEORGE STEVEN
Executive Engineer, Compressor Div
Worthington Pump & Machinery Corp

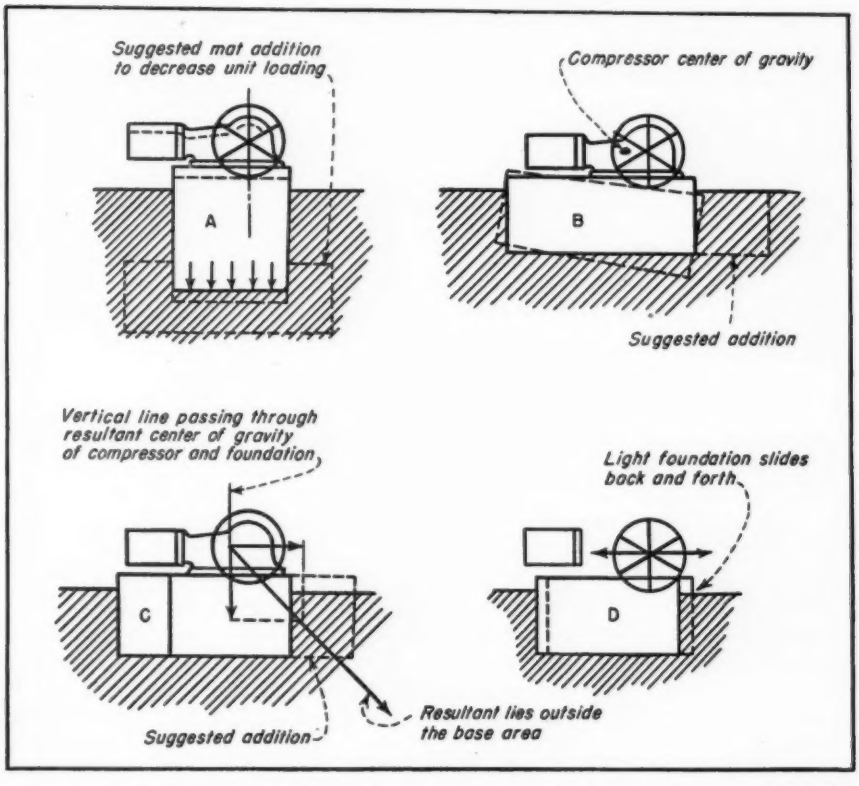


Fig. 1—Foundation must distribute the weight evenly over area sufficiently large so that machine does not settle, slide or topple from unbalanced forces

▶ A PROPERLY DESIGNED and constructed compressor foundation performs two functions: First, it maintains the supported machine in alignment and at proper elevation; second, it minimizes vibration and prevents its transmission to any building structure external to the foundation. If the unit is to fulfill the first function, it must satisfy four requirements:

1. Foundation base area must be properly distributed so the pressure it imposes on the supporting soil will not at any point exceed the safe bearing capacity for the particular soil encountered. The foundation will sink if this requirement is not satisfied, Fig. 1*A*.

2. Base area should be so disposed that there is not too great a difference in unit loading on different, equal areas of the supporting soil. If the unit loading varies too greatly under different parts of the foundation, the block will probably tilt, Fig. 1*B*.

3. Foundation must have sufficient mass of such proportions that the net resultant of the total vertical load and horizontal unbalanced reciprocating forces, always falls within the base area of the foundation, Fig. 1*C*. If it falls outside, foundation and compressor will probably topple or stand at an angle.

4. There must be enough weight in the foundation to prevent it sliding horizontally on the supporting soil because of unbalanced horizontal forces, Fig. 1*D*.

To determine the required thickness of a concrete foundation, it is necessary to know: (1) compressor weight (2) approximate distribution of this weight together with magnitude and direction of any unbalanced disturbing forces and (3) quality of the subsoil.

Foundation Plans. Manufacturer's foundation plans, submitted with the machine, are designed for good, average soil conditions, having bearing-load capacities of about 8 to 10 tons per sq ft. Such plans provide enough thickness to support the compressor's weight, plus disturbing forces, and provide foundation bolts long enough to secure good anchorage. Carefully worded notations appended to the plans, stress the importance of soil quality and urge investigation by a foundation expert if there is any question regarding the soil's ability to carry the load.

Soil quality may vary at different seasons, and be particularly wet in spring and early fall. Consider these conditions carefully because foundations have been known to move when the soil is wet, the movement completely disappearing after the soil has thoroughly dried. In many instances where substantial concrete depth is available in existing basement flooring, or where the footing is solid rock, the only requirement is to apply a surface covering of properly bonded concrete to support the compressor.

There is little sense in excavating perfectly sound structure to provide for a concrete block, such as may be indi-

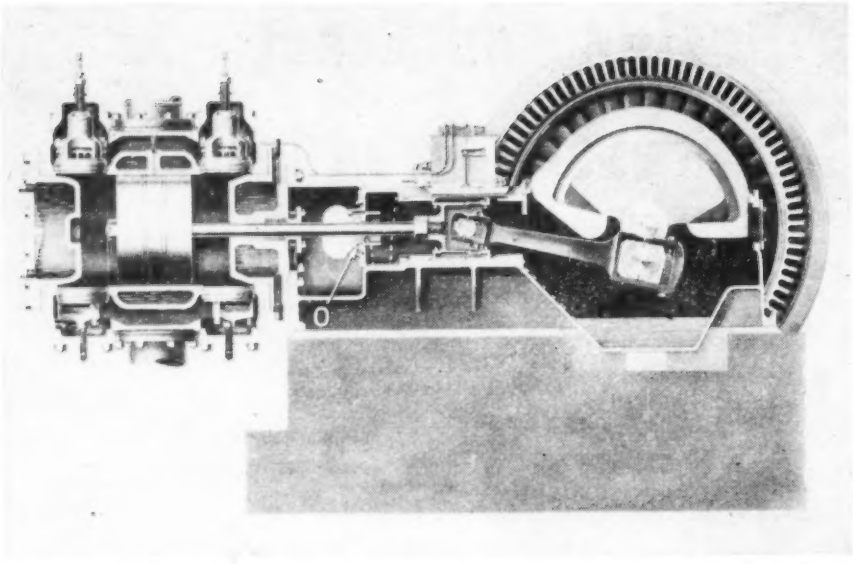


Fig. 2—Moving parts possess mass and hence inertia. When accelerated or retarded, they introduce forces that must be opposed by adequate correctives

cated by the compressor manufacturer's foundation plan. If you lack previous experience with reciprocating equipment in any selected location it is desirable, on any sizable installation, to have soil tests made before proceeding with a foundation that can be extremely costly if improperly set up. The table covers various soils encountered, and gives the safe bearing capacity in tons per sq ft; *the allowable or design loadings should not exceed one fourth of the values given.*

Piling. In certain localities the soil may not have suitable bearing capacity at a reasonable depth; piling will, therefore, have to be used. Under these circumstances structural strength of the concrete block becomes a matter of great importance. Roughly, wood piles can carry 8 to 12 tons per pile, and concrete ones 25 to 35 tons. Average spacing, about three feet, must be carefully calculated, as well as piling angle, to absorb the force of unbalanced reciprocating parts. In addition to vertical piles that support the stationary mass of machine and concrete, others should be driven that line up with directional forces, at maximum allowable inclination to vertical that space limitations allow.

Where building conditions permit, and particularly where the unbalanced force is large, it may be preferable to increase the supporting area by a mat under and extending beyond the foundation proper rather than to use piling, Fig. 1*A*. Mat thickness should be at least 1.7 times mat extension.

There is a limit to how thick a foundation block can be and still maintain loads within the soil bearing limits because every foot of additional thickness adds approximately 150 lb per sq ft to the load, and eventually the soil is incapable of supporting the concrete. Importance of this fact will be discussed later in this article.

Unbalanced Forces. Having determined upon a suitable location for the compressor foundation from the standpoint of soil loading, next consideration is the possible effect of unbalanced reciprocating forces. In a single-cylinder horizontal compressor where pressure in the cylinder produces equal and opposite forces on the piston and cylinder head, the unbalanced forces cancel each other, and therefore have no effect on the foundation. But the moving parts, Fig. 2, possess mass and hence inertia, and when accelerated or retarded, give rise to inertia forces in accordance with the fundamental law:

Force = Mass x Acceleration

Resultant of these inertia forces at any given instant is the free force transmitted to the foundation at that instant. Magnitude and direction of the forces can be readily calculated for each type and size of machine if weights of the reciprocating parts are known. These are piston, piston rod with nuts, crosshead with all attached parts, wristpin, and a portion of the connecting rod, generally taken as one half or one third, depending upon the disposition of rod weight about its center of gravity, Fig. 4.

Rotating weight, consisting of crankpin, unbalanced portion of crank webs and remaining portion of the connecting rod, creates a force which is exerted in a radial direction and of constant magnitude, assuming the speed is constant. Counterweights exert a force similar to the rotating weight, and in a direction generally directly opposite.

CALCULATE SHAKING FORCE

Where shaking forces may affect sensitive instruments or annoy occupants of surrounding buildings, consult the compressor manufacturer about the magnitude of the shaking forces. If you are unable to obtain this information, here is a brief summary of the method used to calculate it. Assuming a horizontal single-cylinder compressor, we have first the force created by the

SAFE SOIL LOADING IN TONS PER SQUARE FOOT

Type of Soil	Tons per sq ft
Solid ledge of hard rock, such as granite	25 to 100*
Sound shale and other medium rock, requiring blasting for removal	10 to 15
Hardpan, cemented sand and gravel, difficult to remove by picking	8 to 10
Soft rock in disintegrated ledge, or in natural ledge difficult to remove by picking	5 to 10
Compact sand and gravel, requiring picking for removal	5 to 6
Hard clay, requiring picking for removal	4 to 5
Gravel, coarse sand, in thick, natural beds	4 to 5
Loose medium or coarse sand; fine, dry sand	3 to 4
Medium clay, stiff but capable of being spaded	2 to 4
Fine, wet sand, confined	2 to 3
Soft clay	1

* It is ordinarily not advisable to impose on any type of soil a unit load greater than 15 tons because the safe crushing strength of concrete (in the foundation) is usually taken at about 15 tons per sq. ft.

reciprocating parts expressed by the following equation:

Primary force, lb = 0.000341 WRN^2 where:
W = weight in lb of the reciprocating parts as previously described
R = crank radius or distance from center of crankpin to crankshaft center line in feet
N = Revolutions per minute

Because of crank arrangement and connecting-rod design in conventional compressors for constant, angular rotation of the crankpin, the reciprocating parts move through varying distances in the same increments of time. These distances are greater at the head end (outward end) of the stroke than at the crank end (forward end).

Thus magnitude of the horizontal reciprocating force is greater at the head than at the crank end. The difference varies with the ratio of L/R where L equals connecting-rod length in feet. Taking the primary force as previously expressed in the equation, multiply this value by $(1 + R/L)$ for the resultant head-end force, and by $(1 - R/L)$ for the crank-end force. If the counterbalances provided are equal in effective weight (resolved to crank radius) to the rotating weight, no further correction to the aforementioned equation is necessary.

First assume, however, that no counterbalances are provided. Then, using the same primary-force equation and interpreting W as the rotating weight, get a value that should be added to both the resultant head-end and crank-end forces already derived.

If counterbalances are provided and they have an effective weight greater than the rotating weight, take the difference between these effective rotating weights, as W, and, using the above equation, determine the force value. This value is deductible from both head- and crank-end forces, bearing in mind that in rotating-weight calculations we disregard the correction for L/R.

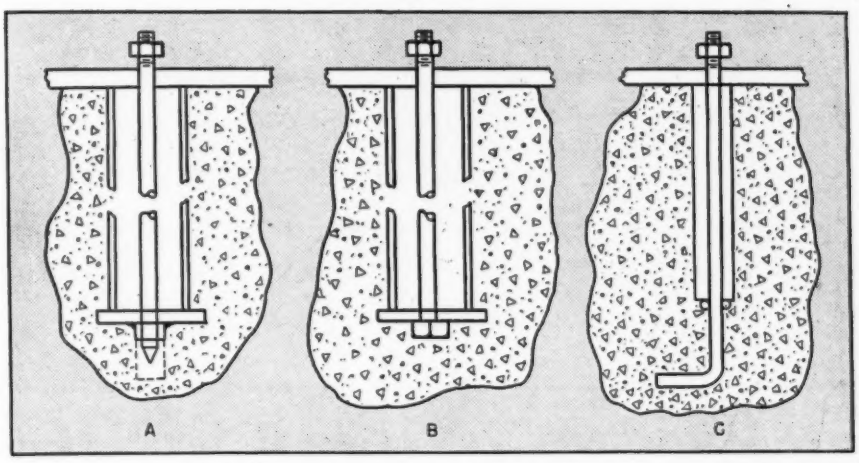


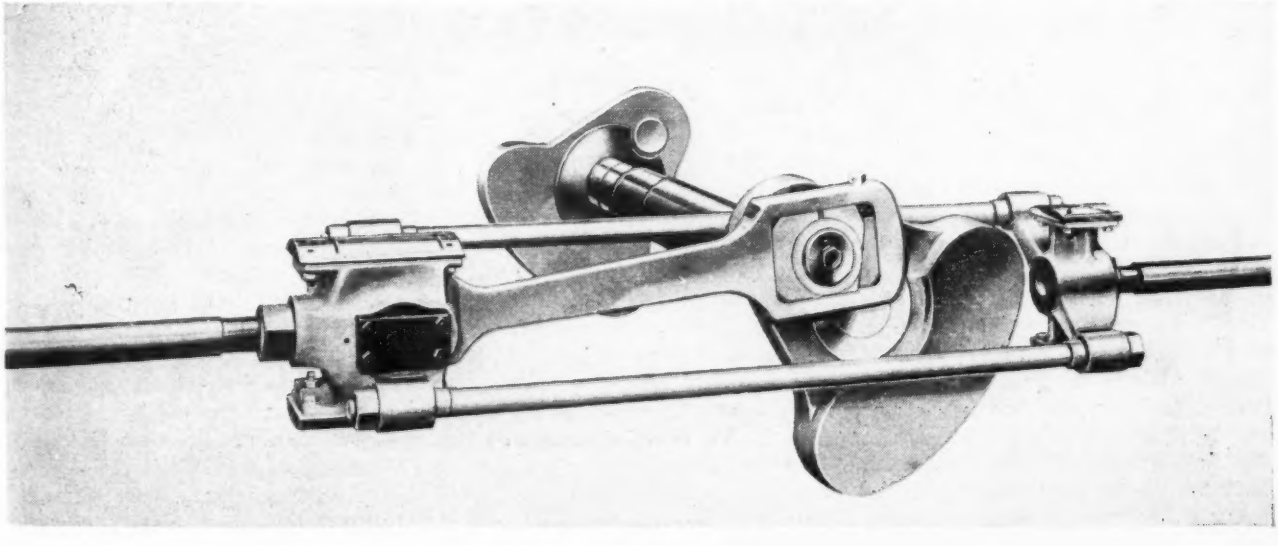
Fig. 3—Removable bolts A are preferred to B and C as machine is skidded into position more easily with bolts removed; also broken bolts can be replaced

It is generally impossible for counterweights to eliminate all shaking forces completely, and disturbances may be set up in the surroundings or result in movement of the compressor and foundation mass. Certain corrections can be achieved by disposition of cranks on multiple-cylinder units, frequently at the expense of instituting couples. The latter, however, do not have as serious effect as free forces.

After all possible correction has been achieved by proper disposition of cranks or other modification to avoid objectional results of free shaking forces, practical experience teaches that, where soil conditions are such as to transmit movement or vibration to surrounding equipment or vicinity, the addition of extra foundation mass can be helpful. While there is no exact value, experience shows that a total mass of equipment, plus concrete equal to 15 or 20 times the value of the disturbing force, will usually eliminate difficulty.

Often this means considerable expense for excavation and concrete, but generally proves the cheapest insurance available. Where multiple units are involved, additional benefit can be derived from tying the separate compressor foundation blocks into a common mass. Since all units seldom operate in synchronism, individual-unit shaking forces tend to cancel each other and thus re-

Fig. 4—Inertia forces come from the piston, piston rod, crosshead, wristpin and part of the connecting rod, generally 1/2 or 1/3 of its length depending upon the disposition of the weight around its center of gravity



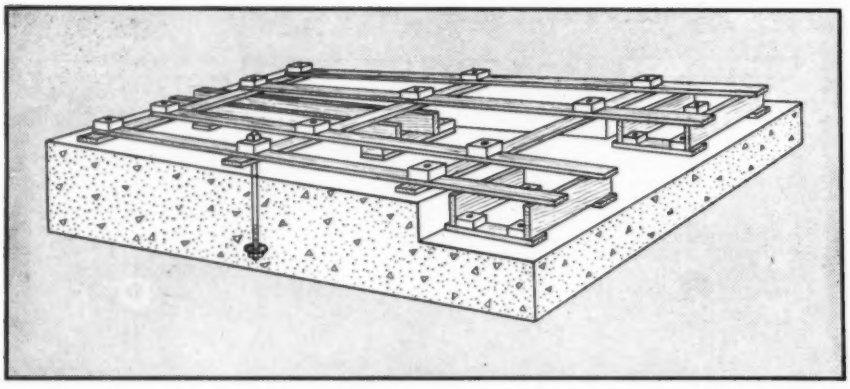


Fig. 5—Template is a pattern or frame fabricated from heavy wood strips which positions and supports the bolts and casings while foundation is poured

duce the tendency to mass movement, which must take place before the effect of unbalanced forces can be transmitted to surroundings. If local conditions make it impossible to add sufficient mass to the foundation block, use vibration isolators. Description of the many types available is beyond the scope of this article.

Foundation Bolts. Foundation or anchor bolts serve two purposes: They (1) hold the compressor down firmly on its foundation, and (2) prevent it sliding laterally on its foundation. Real duty of the bolts then is to bind the compressor firmly so that structurally machine and foundation constitute a single mass. There are a considerable number of foundation-bolt designs but they all fall into two general classes: removable, Fig. 3*A*, nonremovable, *B*.

Except for very small bolts (in the hook classification, Fig. 3*C*), the removable type is recommended for the following reasons: (1) Should a bolt crack or break, a new one can be inserted. (2) Compressor installation is easier if bolts are not in place until the heavy parts have been skidded onto the foundation.

For ease in "finding" the threaded hole in the nut, point the bolts at their lower ends. Most manufacturers furnish a drawing that specifies anchor-bolt dimensions, and their location in the foundation. A purchaser often saves time by buying bolts from a nearby source. In that event the material should not be of lower quality than AISI-C 1120, which has the following physical properties:

Hot Rolled Material
Tensile strength—65,000 psi
Yield point—38,000 psi
Elongation—25%
Brinell Hardness—117

Providing casings of ample length around the bolts permits lateral movement in all directions to compensate for slight inaccuracies in locating the bolts in the foundation and unavoidable shifts of the hole core during casting of the compressor frame and supports. Casings can be made of down-drain pipe, ordinary steel or wrought-iron pipe. Make them about 2 in. larger in diameter than the foundation bolts.

SUPPORTING THE BOLTS

Foundation Template. The template, Fig. 5, is a pattern or frame usually fabricated from wood strips. It supports the bolts and casings, while the foundation is built up around them. Engineering practice dictates using a template because it is more economical to build one than to endeavor to locate the bolts without this guide. It is best to build a template on the job since, if a manufacturer furnished it, damage and warping during shipment might distort the framework and destroy its accuracy. Instructions for building the template can be secured from manufacturer or machine base can be measured on job.

Leveling Wedges. Use iron in preference to wood for wedges. This eliminates the possibility of swelling, and thus disturbing the alignment already set. There has been considerable discussion on the subject of removing leveling wedges. The most prevalent opinion, however, especially for reciprocating machines, is that the wedges should be removed after grouting. Reason is the grout may shrink away from contact with the bottom of the frame or base, thus allowing the wedges to take the whole supporting load. Where the wedges are removed, the base must necessarily rest firmly upon the grout.

Shipshape Safety Gear Prevents Accidents

► PERSONNEL SAFETY EQUIPMENT, which protects against volatile solvents, requires regular inspection, if solvent illness and dermatitis are to be avoided. Such equipment may become useless through deterioration or improper handling.

Ventilating equipment, which provides basic protection against solvent vapors, may become inefficient because dirt accumlates in pipes or on fan blades. It should therefore be cleaned regularly. Inspect fans and other moving parts at frequent intervals to see that they are in good working order, and are handling the proper amount of air. This is especially important at the beginning of the winter season, when partial ventilation afforded by open windows during the warmer months is no longer available.

In addition to inspecting the ventilating equipment, have a competent chemist or industrial hygienist make analyses of the vapor content of the workroom air to be certain it is being kept relatively free of contamination. Many states provide such service through their health or labor divisions.

Where gas masks are used, it is essential that canisters and cartridges be replaced as soon as they are depleted. Check the time record on canisters regularly. In addition, test the masks to make certain that no odor penetrates. Examine the face piece of all respirators for cleanliness and signs of wear, because a good canister provides no protection for a mask that leaks.

Protective clothing must not be cracked or torn. Pinholes in rubber or plastic gloves may be detected either by filling them with water and watching the outsides for leaks, or by wetting the outside of the gloves, inflating, and watching for air bubbles on the wet surface. *Courtesy of Safety Research Institute, Inc.*

THE OPERATING ENGINEER

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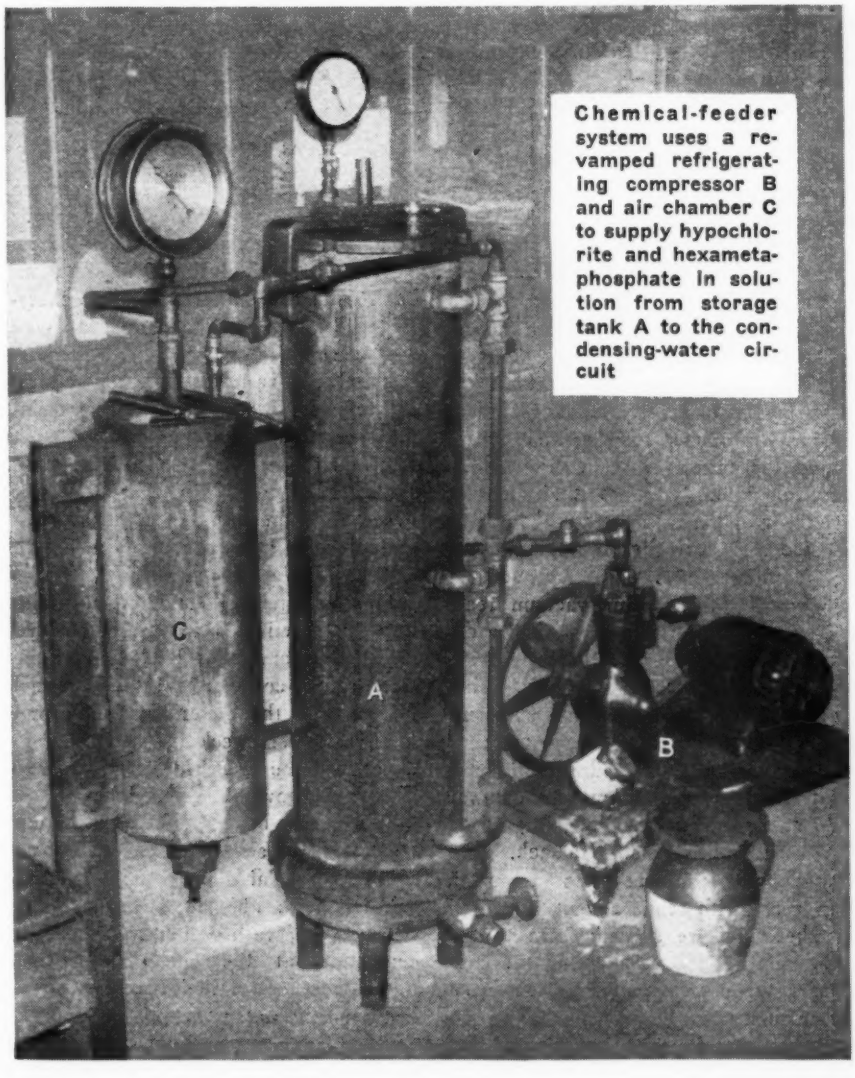
PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Water Know-How Cures Cooling-Tower Headache

George C W Golem, power-plant chief engineer of Atlantic Wire Co, grapples with algae and scale to hold vacuum on a condenser. Final success comes from combining mechanical and acid-tube cleaning with chlorine and phosphate treatment



Chemical-feeder system uses a revamped refrigerating compressor B and air chamber C to supply hypochlorite and hexametaphosphate in solution from storage tank A to the condensing-water circuit

BACK IN 1941 a cooling tower met the need for 800 gpm of circulating water for the condenser of a low-pressure condensing turbine. At least so we thought.

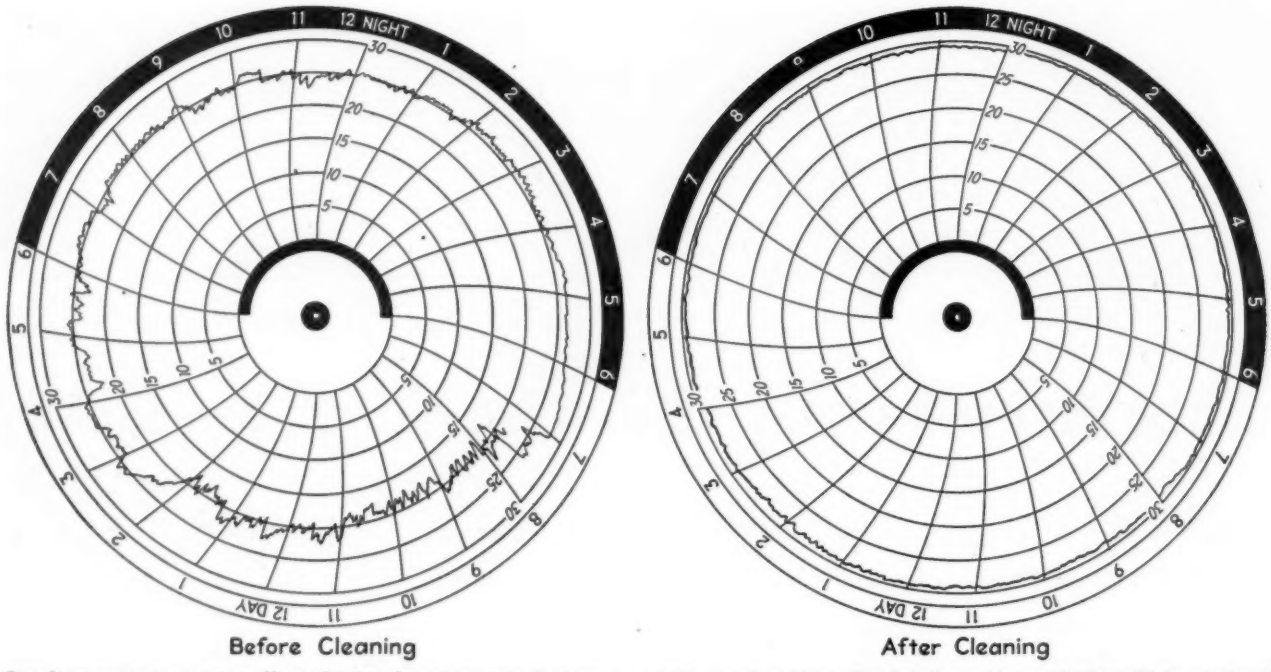
Before we purchased the cooling tower we sought out several plants that had operated such equipment for years. We felt we had all the answers, and running a cooling tower would be a simple matter.

Mechanical operation presents no serious problem. Fans and fan-motor difficulties and, in winter, icing over of louvers are eliminated as readily as they are detected. But water, and more particularly its behavior in circulation, proved the headache.

A cooling tower, of course, serves equally well as an air washer so impurities and pollution in the air appear in the water. Dust, fortunately, settles out in the basin of the tower. Muriatic-acid fumes, sulphuric-acid vapors, diesel-engine exhaust gas and flue gas, mostly CO_2, pollute the atmosphere in and about our cooling tower. These troublemakers don't remove too easily.

Control of Water. Expecting trouble from this source, we set up a close check on our water right from the start. Sap from the tower wood discolored the water in the early days so a pH test was impossible. Several drainings and the passage of about six months cleared up that annoyance.

Our tests revealed a pH of about 4.0, so we hurried to save our condenser tubes from exposure to water like that. Soda ash, to the tune of 5 lb daily at first and eventually by gradual stages to 25 lb daily, brought the pH up to 7.5 when applied directly to the water at the basin level. By the following morning pH slid off to the acid side again. About six weeks of this treatment and several changes of water brought the pH



Condenser vacuum-recording charts show vacuum improvement from mechanical-brush cleaning and condenser-tube drill. Left: 25-in. "before" reading. Right: 28-in. "after" reading produced 62.5% increase in daily turbine output

to 8.0 without its dropping below 7.0.

Then we opened the condenser. All the lower rows of tubes were filled with mud; scale formation appeared on tubes and heads, being especially heavy on the hottest part of the condenser. We launched what we knew would be a long drawn-out process—the search and approval of chemical methods to remove mud and prevent scale.

First we sought a chemical for a double-edged purpose: precipitation of scale-forming impurities and dissolving of existing scale without making a complete change of water necessary every few weeks. An extensive correspondence brought many suggestions but none held the solution. In fact, we formed the opinion that either little was known about effective treatment of cooling-tower water, or so far we had not contacted the right person. One suggestion we received had been tried for about three months. It precipitated the solids in the water all right, but they settled out in the lower part of the condenser and aggravated an already serious condition. In addition, the existing scale remained untouched. During this period of experiment the vacuum on the condenser began to slide off and cleaning became a monthly task.

Early Tube Cleaning. At the beginning we cleaned the tubes by washing them with rubber hose and nozzle. Next, we used plugs, pushed through the tubes by hand, since we had no compressed air. Lastly, we shoved a wire brush through—all in all, a long, expensive process that did not remove any appreciable scale.

Then we had another idea. We recalled that during the spell when water was on the acid side the condenser enjoyed freedom from scale. So we added inhibited muriatic acid to circulating water in various amounts at definite intervals. Samples taken every ten minutes from condenser outlet indicated a pH drop to 5.0 after adding acid, and a return within one hour to 8.0. For one full week, six hours of each day shift, this treatment continued. When we opened the condenser we found the tubes on the entrance side very clean for part of their length. The rear of the condenser and the outlet side showed negligible improvement, so acid treatment was discontinued.

Operating Aids. Our vacuum reading now showed 24 in. as against a desired 28 in. We reasoned that increasing the impeller size on the circulating pump (the pump motor had sufficient capacity) would give a greater flow and a higher velocity and possibly prevent sludge accumulation in the lower part of the condenser. Vacuum jumped to 26.5 in., but it soon fell back. The low-vacuum problem was removed, however, with the advent of cold weather, and we settled down to the cold monthly job of shooting the condenser tubes with plugs driven by a water gun.

We took one more ill-fated crack at the job of improving vacuum—a treatment combining caustic soda and trisodium phosphate—before we made the first real step towards a solution.

ALGAE REMOVAL

That step came about from a chance conversation with the manager of our local water company to whom we related this seemingly hopeless situation. He referred us to his company's chemist, who identified the sludge as algae and secondary growth. He recommended the restrained use of cupric sulphate followed by a chlorine treatment of the water. The reason for a restrained use of cupric sulphate was the strong possibility that a heavy dose would free all the algae at once and plug up every condenser tube.

Accordingly we started with cupric-sulphate treatment of one lb, and gradually increased this to 12 lb, divided in 3-lb lots and placed in each of the tower's four corners. We then drained off part of the water each day and finally after six weeks opened the condenser. Gone were sludge and slime! The scale, however, seemed heavier.

When we began our chlorinating treatment we settled on a 2-gal. feed of locally available sodium hypochlorite solution with about 2% of available chlorine to give a 4-ppm chlorine concentration at the condenser outlet. Batch treatment failed because its effect upon the water was only temporary. So we planned a continuous treatment.

Chemical Feeder System. Because of difficulties from location and freezing weather we abandoned any thoughts of a barrel-fed gravity system. From an operating and maintenance standpoint it seemed preferable to locate our feeder at engine-room floor level.

We devised our own container from a 41-in. length of 10-in. pipe on which we placed a steel cover with a groove machined into it to hold a rubber ring. This cover was tightened down with a clamp. A water gage was made up from pipe fittings and unions. Since the outgoing chlorinated solution is about the same color as the water and defies an easy check on its rate of feed, compressed air seemed more positive than tying the tank in parallel with the condenser and relying upon pressure difference for feeding solution.

We built an air chamber from a 24-in. length of 8-in. pipe and connected it to the chemical feeder and a revamped domestic refrigerator compressor. An altitude gage on top of the feeder, with its index pointer set at the pressure of the circulating-pump suction line, gives a check that air pressure on the feeder, adjusted by a needle valve, stays enough above suction-line pressure to empty the tank in 7½ hr. The complete feeder assembly is pictured on page 103.

For a while we operated with a solution of sodium hypochlorite for bacteria control and caustic soda for holding pH to 8.0. Our slime and sludge difficulties disappeared but our scale problem seemed to grow. We resorted to various cleaning methods, described later, to remove existing scale and called in a chemical consultant to advise on proper water treatment. Final and successful treatment substituted a hexametaphosphate (1½ lb in a gallon) for the caustic soda and fed at the rate of about a pint a shift. Sodium hypochlorite continued as the bacteria control with enough added to the solution to give a chlorine residual of 0.2 to 0.5 ppm at the condenser outlet. In addition, a 10-minute blowdown per shift reduced concentration.

CLEANING CONDENSER

Our experience in tube cleaning covered mechanical and chemical methods. We rigged up a motor-driven tube cleaner, consisting of a hollow shaft. On one end of it a rubber hose was attached, and on the other a brush or a special drill was screwed. Three men operated this rig by first passing a steel-wire brush through all tubes. While tube surfaces appeared bright a second cleaning with the drill head on the hollow shaft removed more than twice the scale previously taken off. Time for these operations ran from 10 hr for the brush to 24 for the drill.

As a result of this cleaning, discharge head on the circulating pump dropped from 74 to 63 ft; vacuum rose to 28 in.; daily turbine output increased from 2400 to 3900 kwhr, a 62.5% jump with 6% less load on the uniflow engine. (The turbine operates from the uniflow exhaust steam.)

CHEMICAL ANALYSIS OF CIRCULATING WATER

Differences in Composition at Two Different Dates

Component	Symbol	2/44	4/45	Component	Symbol	2/44	4/45
pH		9.0	7.6	Calcium	Ca	65	72
Hydroxide	OH	0	0	Magnesium	Mg	15	19
Carbonate	CO_3	74	0	Soap hardness	$CaCO_3$	222	257
Bicarbonate	HCO_3	711	181	Suspended solids	Estimated	3-4	High
Sulphate	SO_4	..	..	Calgon	As $NaPO_3$	6.2	14
Chloride	Cl	97	111	Orthophosphate	PO_4	5.8	7.5
Iron	Fe	..	1.1				

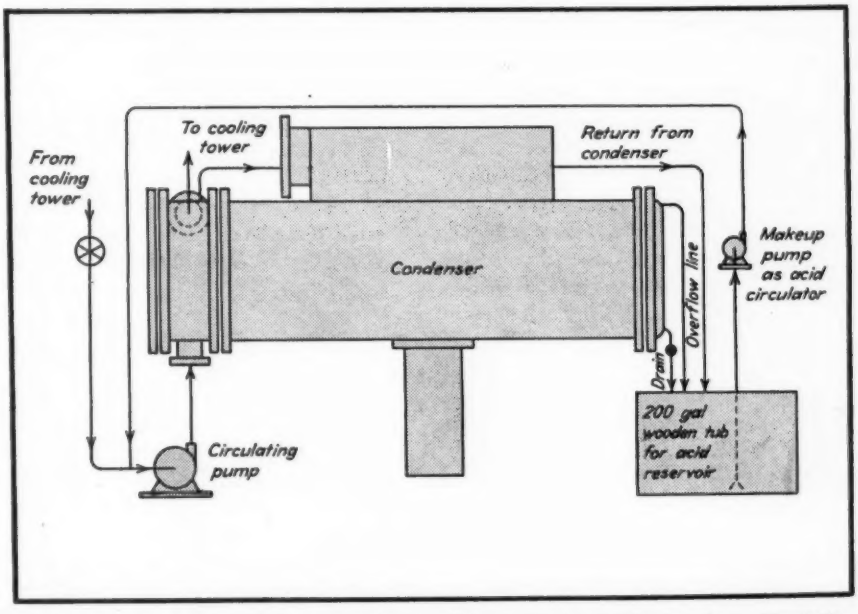
FINAL SCALE REMOVAL

Acid Cleaning. Because of the heavy labor in its operation we decided to experiment with acid cleaning for future scale-removal jobs. We began with 12½ gal of muriatic acid in 180 gal of water with 1 qt of an inhibiting agent. After a 10-min stirring we pumped this solution through the previously drained condenser and circulated it for two hr. After draining the acid solution we neutralized and flushed the condenser until a satisfactory pH of 7.0 was reached and held by the water.

After another try with this method we used at our last cleaning a 5-gal addition of acid and checked the solution every 20 minutes in circulation. We kept up circulation until the check showed no more absorption of the acid. We next neutralized and flushed the condenser prior to inspecting it. It proved clean to the metal.

From a cost sense acid cleaning is most attractive. Advantages are: (1) A regular Sunday shift can handle it. (2) Cost of materials is little. (3) An excellent job results. Mechanical cleaning, on the other hand, requires time for dismantling and assembling.

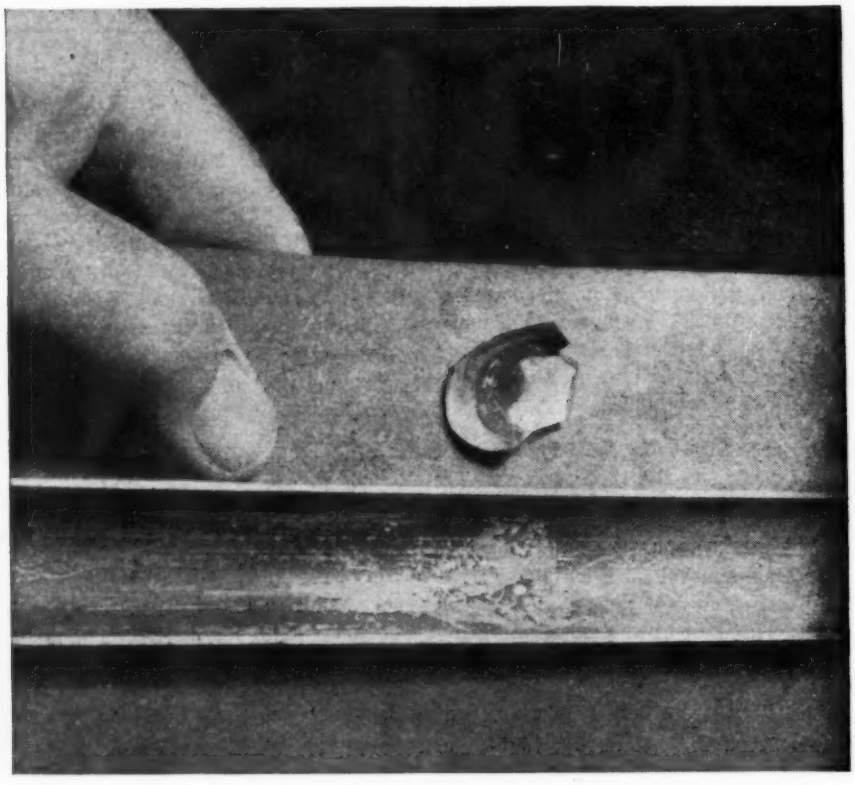
It is our opinion that cooling-tower and boiler operation have much in common. Both require (1) makeup which increases concentration (2) blowdown to control concentration (3) chemical water treatment to prevent scale formation and corrosion (4) tube cleaning employing almost the same removal methods if scale should develop.



System setup for removal of condenser-tube scale by acid cleaning. Muriatic-acid solution and a corrosion inhibitor circulate until acid absorption stops

PRACTICAL AIDS TO OPERATION

Plant-Tested Methods and Ideas for Power Men



MUSSEL SHELL SHUTS DOWN TURBINE

CIRCULATING WATER for our condensers carries considerable solid matter in the form of clam and mussel shells and other debris. Most of this is taken out by the revolving screens, but small pieces get by and into the condensers. Each night we wash out with jet cleaners any of this material that may lodge in the condenser tube. Once in a while, however, despite our best efforts, a piece of shell or other object lodges in a tube, and remains there until the condenser is opened for inspection and cleaning.

In one case a piece of mussel shell lodged in a tube and resisted all efforts to wash it out. The shell directed the cooling-water flow at high velocity against the tube's side in such a way as to remove the protective film and expose the metal to oxygen corrosion. As the photo shows, this action finally cut a hole about ⅜ in. in diameter through the tube's wall. When this happened, condensate salinity became so high we had to take the turbine out of service, and plug the faulty tube. Later when we removed the tube, cut out and split the faulty section, the piece of shell was found attached to the metal. A small thing to cause so much trouble.

Glen Cove, N. Y. M. E. MARSHALL

Pulley Causes This Motor's Unbalance

OUT-OF-BALANCE OPERATION of machines can be baffling and annoying. The bad vibration of an old 7.5-hp 1200-rpm dc motor with a smooth-core armature indicated serious out of balance. The motor, mounted on a platform supported from the ceiling beams, connected to its load by a long leather belt.

At first we though the unbalance was caused by improper winding distribution on the armature core. Proper distribution of the winding on a smooth-core armature depends largely on the winder's skill. After the armature had been checked for static balance twice without reducing the running unbalance and vibration, attention was given to the motor supports.

Stiffening the platform on which the motor was mounted did not improve operation so attention was turned to pulley and belt. We removed the armature and sent it to the shop with the pulley. The latter was badly out of balance because it had been bored off center. Balancing the pulley by adding weight to the light side of its rim corrected the trouble and gave smooth operation.

When adding weight to correct unbalance put it opposite the place where unbalance occurs. If this is not done, machine may vibrate badly even though its rotor is in static balance. For example, if the weight to balance the pulley had been added to the armature's commutator end, the assemby would have been in static balance, but out of running balance at both ends. As a result the machine probably would have vibrated badly when running. Baffling cases of machine vibration have been traced to this cause.

Philadelphia, Pa. S O SMITH

How One Plant Keeps Oil Out of Boilers

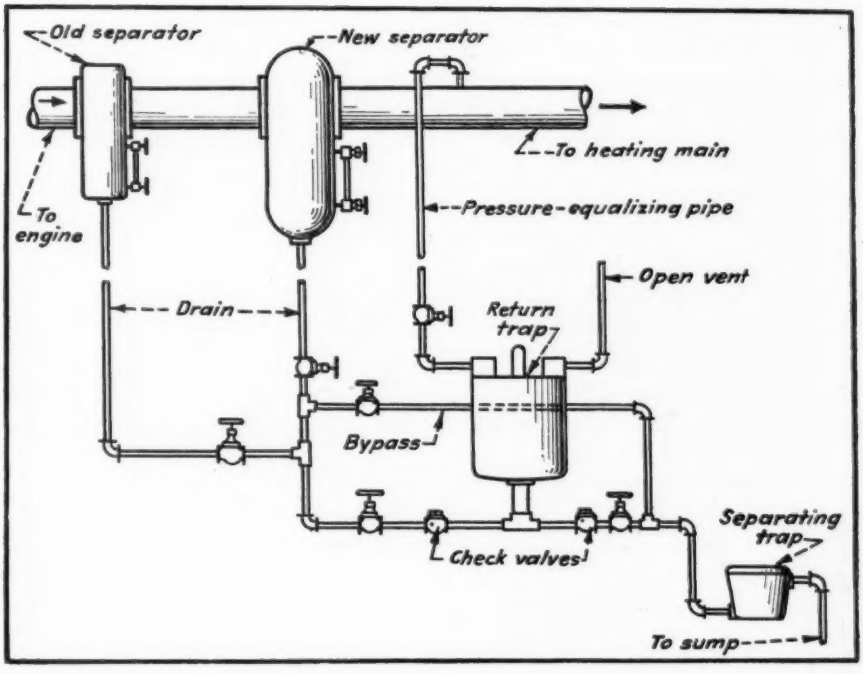
WHEN I STARTED in my present job we had trouble with engine cylinder oil getting in the boilers. To eliminate this difficulty I changed from a compounded to a straight mineral cylinder oil, and made a search to find how oil was getting into the feedwater system.

Exhaust steam from a vertical uniflow engine goes into our vacuum-return heating system. Return vacuum is held at about 9 in. and exhaust line pressure varies from 3 psi to 2- or 3-in. vacuum depending on relation between engine and heating loads. There was a small, inefficient oil separator in the engine-exhaust line and a stocking

grease extractor in the feedwater line located between the feed-water pumps and the boilers.

The oil separator's bottom connected to a separating trap, discharging to the sump. We discovered that at night when the engine was lightly loaded heating-system vacuum extended back through the separator. This permitted air to be drawn in through the trap and prevented it draining the separator, so the latter filled and flowed over into the heating system. From here the oil flowed through the return line to the feedwater heater and to the boiler as there was too much oil for the filter to handle.

To correct this condition we replaced the separating trap with a return one that has an equalizing connection to the heating main, as in the diagram. This connection permits the oil separator to drain to the trap under positive pressure or vacuum.



Originally feedwater and vacuum-pump exhausted directly to the open feedwater heater without going through a separator. When we installed the return trap and separator in the engine exhaust line we also put one in the pump exhaust line.

These changes reduced the oil in the feedwater, but not enough. So we installed a new 10-in. separator in the engine's 6-in. exhaust line, and left the old one in place, see diagram. When making this change we connected the feed and vacuum pumps' exhaust line to the main exhaust on the engine side of the new separator, to remove any oil not taken out by the pump exhaust separator. Our oil-eliminating system is now highly efficient. Only a slight trace of oil can be found along the water line in the boilers, not enough to be of consequence.

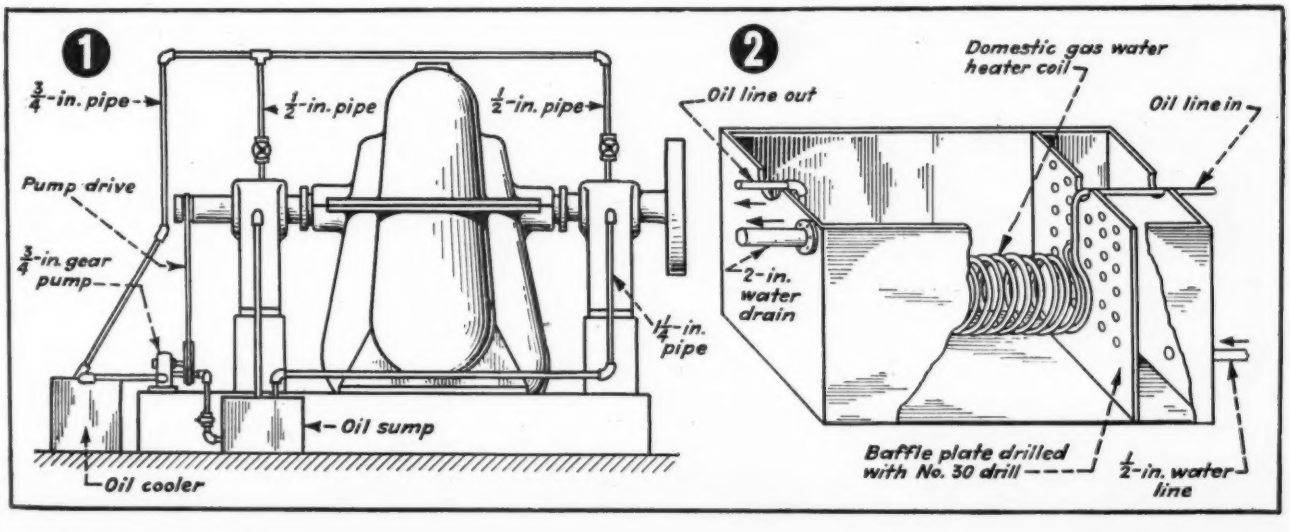
Boston, Mass. C ROBERT KENNEY

HOMEMADE COOLER CONDITIONS LUBE OIL

SEVERAL YEARS AGO we changed a pump impeller for one of about 40% greater capacity. Despite several attempts at improving the double-suction impeller's hydraulic balance its 4-collar marine thrust bearing ran quite warm. While this bearing probably would have operated that way indefinitely without harm we decided to reduce its temperature by cooling the bearing lube oil.

Because of insufficient space in the bearing to install an effective cooling coil we decided on an external cooler with a circulating pump to cool the oil in both bearings, as in Fig. 1. Oil rings were left in the bearings and the return pipes to the oil sump were located in bearing housings to maintain a safe oil level for ring lubrication, if the oil-pump belt failed.

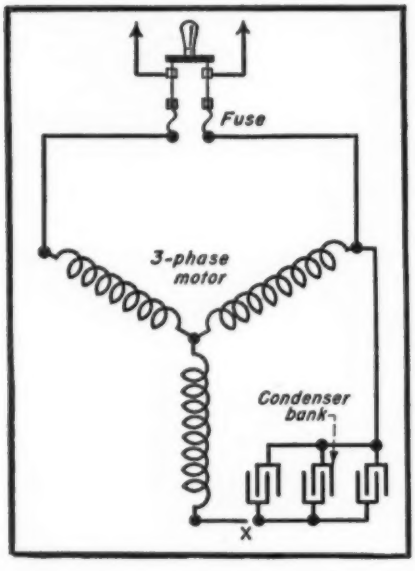
The original installation had an unsightly looking tank on top of the pump to maintain a constant head on the oil pump. For this tank we substituted the arrangement in Fig. 1, and found that by regulating the stopcock in the pump's suction line and the valves in the bear-



ing delivery pipes, an ample oil supply was circulated and oil level in bearings maintained constant.

We made the cooler from a domestic gas water-heater coil with two ½-in. copper tubes in parallel. We mounted this coil in a cooling tank with a baffle plate in one end, Fig. 2. The cooler has given good service for ten years. Cooling-water temperature varies from about 32 to 70 F, and bearing-oil temperatures that used to be about 150 F now run a maximum of 110 and a minimum of 100 F.

Hamilton, Ont. J A COULDEN

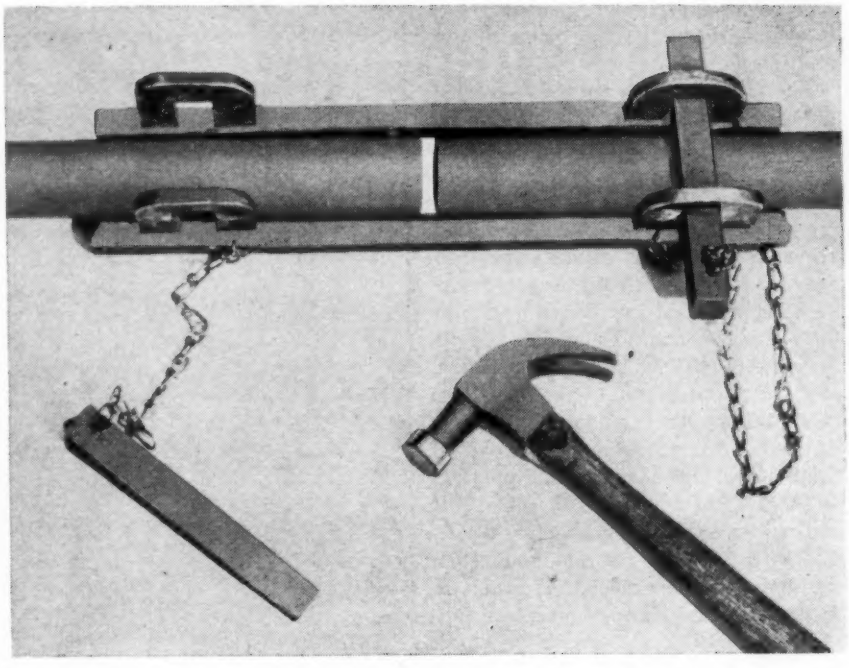


Three-Phase Motor Operates on Single Phase

I WAS CALLED into an office building to determine why a motor-driven exhaust fan would not start. The motor was wound for 3-phase power but operated on a single-phase circuit. To provide a starting circuit three static condensers were grouped in parallel and connected across two of the motor terminals, as in the diagram. These condensers split the single phase and gave the effect of connecting the motor to a 2-phase circuit, making it self starting.

When I closed the switch the motor made a humming sound, which indicated that at least one circuit through its winding was energized. When turned by hand, the fan revolved freely, showing that the bearings held the rotor free of the stator core. These tests indicated that the trouble was in the starting circuit, which had broken at the condenser bank, as at *X*. When this connection was repaired the motor started in a normal manner.

Philadelphia, Pa. B A BRIGGS



CLAMP HOLDS PIPE IN LINE FOR WELDING

LEE FULLERTON, pipe foreman at Kaiser Shipyards, comes up with the pipe clamp in the photo. It is supposed to end most of your troubles if you have difficulty lining up pipe and holding it in place during welding. It consists of two flat pieces of steel, placed with their inside ends about 3 in. apart. To these are welded steel bars to form a channel in which the pipe is placed. Bars should be just far enough apart for the pipe to fit snugly in the channel between them.

At each end of the clamp weld two U-shaped clips, through which drive steel wedges to hold the pipe ends as shown. Pipe ends can be positioned easily and the wedges driven in the clips to hold them for welding. When the pipe's top sides are joined the assembly is turned 180 deg for joining the bottom sides.

Instead of making the clamp's base by welding use a piece of channel iron of correct size for the pipe and weld the U-shaped eyes to its sides. A hole may also be cut through the channel's bottom to permit the welder to connect both sides of the pipe during one setting of the clamp.

R G SWISHER
Troy, Ohio *Hobart Bros*

Meeting Emergencies in Steam-Boiler Operation

MEETING AN EMERGENCY calmly and without delay often requires anticipating it and knowing just what to do. Keep the following suggestions in mind and you may avert the cause of a serious accident:

Low Water. If water level is dangerously low or at an unknown point below the glass, shut off all burners or smother the fuel on grates. Wet ashes or green coal may be used for the latter. If the fuel bed is heavy, use of a fire hose may be justified, but take care to keep clear of resulting steam. Cool the boiler with full draft, but leave all feed valves as they are. Close the steam valve if other boilers are in battery. Have the boiler inspected for damage before proceeding with operation.

Tube or Blowdown Failure. Feed all water possible to the boiler in an effort to maintain water level. Extinguish the fire as outlined above. Close the steam valve if other boilers are in battery. Have boiler inspected to determine damage and cause, also possibility of future failures.

Steam-Line Failure. Extinguish the fire as described above and attempt to control the water level. Shut the stop valves and extinguish fires in all boilers supplying steam to the defective line.

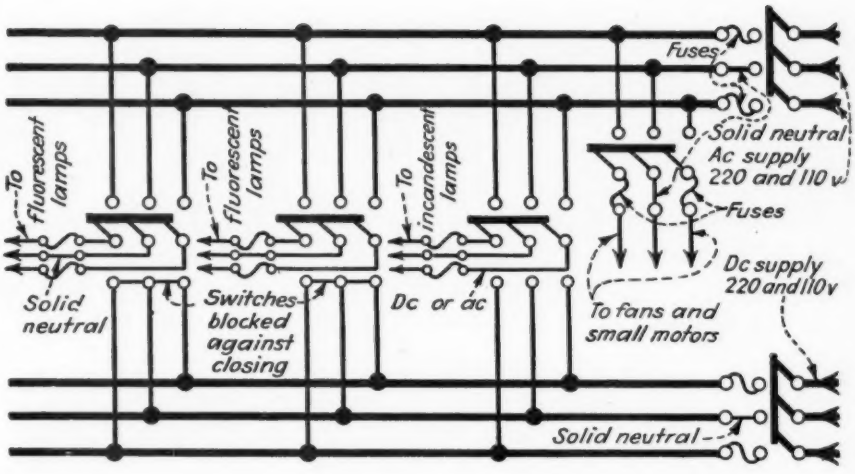
Bulge on the Shell or Fire Sheet. Shut down the boiler immediately and have it

inspected before proceeding to repair the damage.

Steam Leaks. If leak develops at a gasket, bolted joint, or beaded tube end, repair as soon as possible. If leakage appears from riveted or welded seam, or through the brickwork from an unknown source, shut the boiler down at once and then have an inspector investigate the condition.

Safety-Valve Difficulties. If a safety valve sticks open, do not hammer it. Remove the bonnet at the top and tap the top of the spindle lightly. Be sure the pressure-gage line is not obstructed and that the gage is correct. If the safety valve does not operate properly, have the manufacturer overhaul it.

Canton, Mass. HARRY M SPRING



Solid Neutral Keeps The Voltage Balanced

OUR BUILDING IS WIRED for 3-wire 110- and 220-v dc or ac and arranged so all lights can be switched from one supply to the other. Fans and small motors were kept on an ac circuit as there was danger they would overheat if connected to dc power. The distribution panels were arranged for 3-wire with fused neutral. Because of grounds, overloads and badly unbalanced loads on the two sides of the system, neutral fuses blew and unbalanced the voltage.

This condition was not objectionable with incandescent lamps as they were not overly sensitive to unbalanced voltage and their renewal cost not a serious item. However, when we installed fluorescent lighting a blown neutral caused sufficient variation in voltage to burn out the ballast on these lamps. When this happened we changed the distribution panels from fused to solid neutral as in the diagram. This solved our problem and saved time and expense in maintaining the lamps. Circuit supplying fluorescent light is blocked as shown so that they cannot be connected to the dc system.

Ottawa, Ont. JOSEPH BONGIORNO

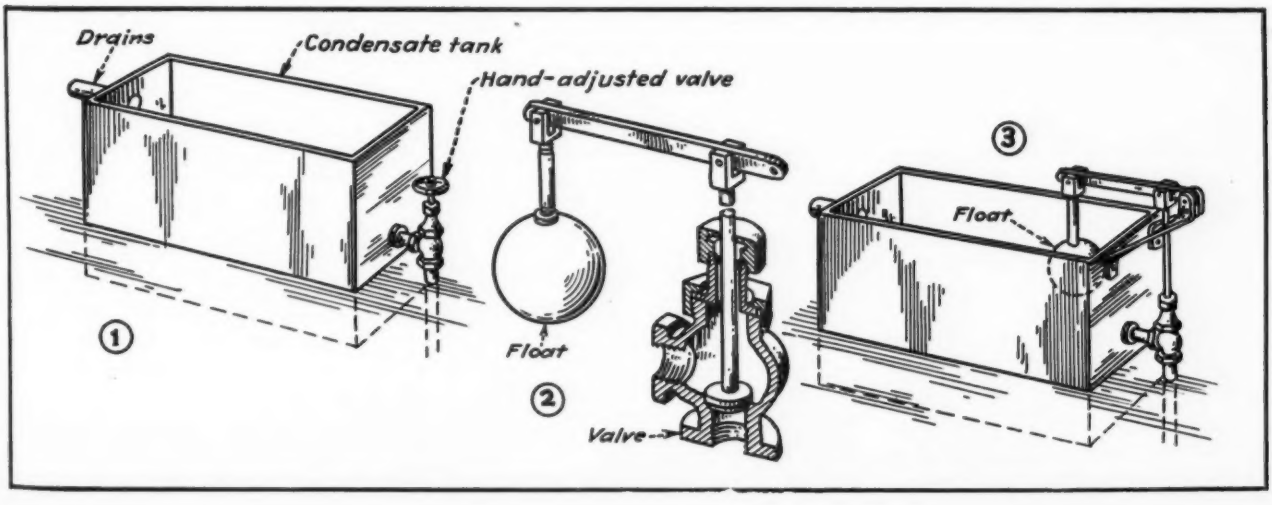
FLOAT-CONTROLLED VALVE HOLDS CONDENSER'S VACUUM

CONDENSATE FROM STEAM LINES and other sources in our plant discharges into a drain tank, from where it flows to the main turbine condenser. Flow from this tank was originally controlled by a hand-adjusted valve, Fig. 1. This valve required frequent adjustment to prevent the tank overflowing and wasting condensate, or running dry and letting air into the condenser.

To eliminate this condition we arranged to position the valve automatically by a float in the drain tank. As shown in Fig. 2, we replaced the valve stem with a long one without a thread. A fitting was made for the stem's top end to connect to the float lever and installed as in Fig. 3. With this arrangement, as the water level drops in the tank the float goes down and closes the valve to reduce flow to the condenser. Increased flow into the tank raises the float to open the valve and increase the flow to the condenser. The float is adjusted so it closes the valve before water level in the tank gets low enough to let air in the condenser.

Since drainage from the tank is on top of the valve's disk, air cannot leak into the condenser between the valve stem and its packing. Therefore, the packing need be held with only sufficient pressure to prevent water leaking out under a head of about 12 in. Consequently, the packing creates very little friction on the stem, thus permitting the float to operate the valve readily.

Flushing, N. Y. S M ELONKA



READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

1—What Is Best Method To Build Coal Conveyor?

JUST BEFORE THE WAR we installed two stokers to fire our two 425-hp *hrt* boilers that had previously been handfired. The stokers are equipped with small storage hoppers that we have to keep filled with coal by hand-shoveling because conveyor equipment could not be obtained when the stokers were installed. We had always planned to install a conveyor system after the war, but now find that what we want is unavailable.

I believe we could build our own conveyor and save waiting another 12 to 18 months. The coal bin is located alongside the boiler room. I had in mind using a screw conveyor with an adjustment to keep both hoppers full. Before starting construction I would like to find out what POWER readers have found most satisfactory on similar systems, and how they adjust the flow of coal to each stoker without filling first one hopper and then the other. If any such systems are in operation I would appreciate it if a simple diagram is sketched showing the arrangement.—*HBL*

2—Will a Slipring Motor Pull This Load?

TO REPAIR a 25-cycle synchronous motor, rated at 150-230 hp. 203-406 amp 375-750 rpm, we intend to replace it temporarily with a 200-hp 230-amp slipring motor. We are not sure whether the slipring motor will pull the load because the synchronous motor draws between 450 and 500 amp at about 97% pf, I know the slipring motor is not as efficient as the synchronous motor, which draws its magnetizing current from a source external to the power supply.

The slipring motor must draw magnetizing current from the line and I am wondering whether this doesn't affect the motor power enough to keep it from carrying as much overload as the synchronous motor carries.

Are POWER readers familiar with a condition like this one, and can they tell me what to expect from the slipring motor? I would like to know what the motor can do as we don't want to shut down unexpectedly or burn out our motor.—*MT*

Answers to December Questions

What Bows the Tubes in Low-Pressure Hrt Boiler?

(This is Question 1 from the December issue, with best answers from readers.)

SKETCH (*December Q-1*) *shows conditions of our hrt boiler. This boiler operates at low pressure, 15 psi. All tubes except the top row are bowed as shown in the sketch. The extent of bow on the worst group is best described as leaving only one half a circle visible when a light is held at one end and viewed through tube at the other end. The shell and through-stays show no signs of overheating or forcing. Can* POWER *readers tell me what caused this condition. What can we do to avoid similar trouble in the future?—RTA*

Replace Top Tubes

RTA's BOILER HAS at some time suffered low-water damage. Examination of lower parts of shell plate will undoubtedly reveal repairs. The repairs may have consisted of (1) driving back bulged shell plates, recalking lower portions of the girth seams, reheating the rivets in lower portions of these same joints, or (2) seal welding at joints.

Damage described could be caused only by this fault. Upper row of tubes receives gas at the highest temperatures. Therefore, distortion in these tubes would be greatest. A recommendation on the spur of the moment might well be to replace the upper row of tubes. Then if the boiler inspector considered other tubes tolerable he might add the recommendation to reroll tubes below the top row to make them tight. After all, stress distribution in a bowed tube in a firetube boiler does not produce an important hazard.

Canton, Mass. H M SPRING

Editor's Note: *Every month several good answers cannot be published because they arrive too late to meet our deadline.*

Give your answer a chance; be prompt with your reply. All answers that reach us before the 22nd of February will receive consideration for the next issue. Let yours be among them.

Boiler Gets Too Hot

IT SEEMS LOGICAL to conclude that the bows in *RTA's* boiler are caused by a considerable difference in temperature. There is a possibility that rear wall is too close to tube sheet. This forces most of the hot gas through lower tubes. With a scaled condition on water side of tubes, expansion increases in proportion to the volume of hot gas passed. The cooler upper tubes expand less than the through stays; therefore lower tubes bow down. Forcing the boiler and admitting cool feedwater around upper tubes aggravates this condition.

Bronx, N. Y. H H DEMLING

Combustion Is Incomplete

THERE MUST BE some overheating of *RTA's* boiler tubes. This may be caused by improper circulation of boiler water or by having furnace temperature too high because of improper bridgewall. His trouble may also be caused by incomplete combustion in the furnace. Therefore, when unburned fuel reaches end of the tubes it completes the combustion and causes overheating of tubes in that area. Too high draft would also cause this condition.

I suggest *RTA* make a thorough check-up on combustion and draft. Excessive scale on the water side of the

tubes and excessive soot and flyash in tubes would also help create this condition.

Newark, N. J. R C Conk

Change Stress in Tubes

It appears that *RTA's* boiler is being forced. It is operating at only 15 psi, which indicates a relatively low over-all temperature. If the steaming rate is too great some tubes will be overheated. Incoming feedwater may prevent top row of tubes from overheating.

Operating the boiler at higher pressures and a greatly reduced steaming rate would be a possible solution to his problem.

If the steaming rate for the boiler is not exceeded bent-tube condition may be corrected by rolling in new tubes that have been previously chilled. Thus setting up a tension stress in tubes when boiler is cold decreases or eliminates the compressive stress in hot tubes.

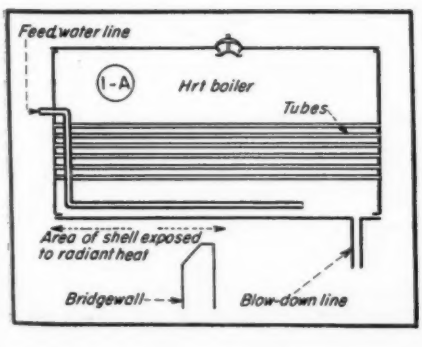
Milmont Park, Pa. J W Heckman

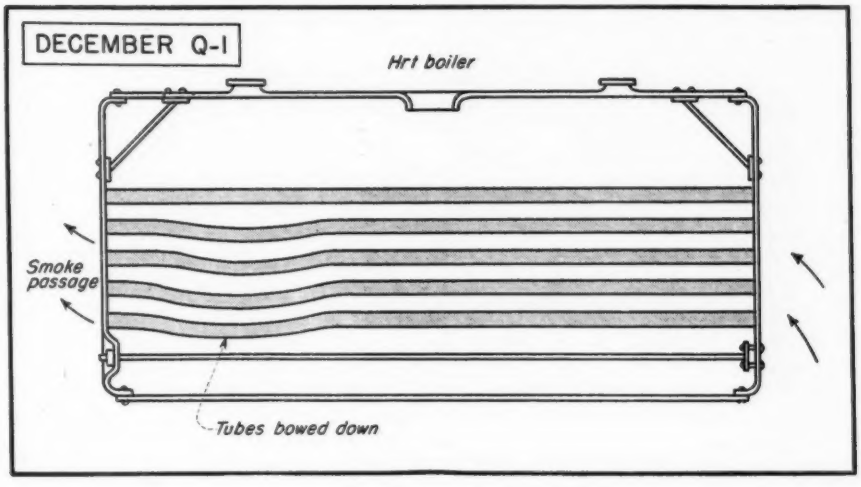
Scale Overheats Tubes

It is evident that bowed section of firetubes occurs immediately over firebox. This is, of course, the hottest part of boiler, as indicated in sketch 1-*A*. It is also point of boiler where water rises with the greatest speed. When this water flows past the firetubes, additional heat is imparted to it, and a considerable part turns to steam, leaving behind whatever salts are dissolved. This forms a scale which adheres to tubes. This scale acts as an insulating material with the result that tubes overheat at that point and bend downward.

To avoid a recurrence I recommend: (1) adequate treatment of boiler water (2) frequent, short blowdowns, rather than infrequent, long ones (3) arrangement of feedwater lines that equalizes as much as possible the temperature inside boiler.

Paterson, N. J. F M Giordano





Analyze Feedwater

Has *RTA* considered the tube trouble in his hrt boiler from angle of possible feedwater impurities?

He states there is no sign of overheating, but it would appear that bowing of tubes can be charged only to overheating of some kind. Although overheating may not be apparent, lack of circulation caused by incrustation on tubes could be cause of the trouble. If there is any sign of pitting on tubes, it indicates poor feedwater.

A feedwater survey should be made by an expert to correct conditions.

Dolbeau, Que. R A Lane

Tubes Are in Compression

There are several reasons why tubes in firetube boilers buckle downward. The scale, which usually lodges on top of tubes, forms an insulation between the water and the source of heat, so the upper side of the tube is overheated. Tubes that are higher up in the bank are not so hot because of greater distance of flame travel. Consequently upper tubes assist in holding the boiler heads together, and as a result the lower overheated tubes are in compression. Compressive force naturally causes the tubes to buckle downward because the upper side is much hotter and therefore weaker.

Newark, N. J. J H Squires

Overheating Bows Tubes

RTA's trouble with tubes in his hrt boiler is most likely caused by overheating of tubes. This, in turn, is the result of scale accumulation on the outer surface, which prevents the rapid transfer of heat. This seems most likely since no overheating or forcing of the through stays has been observed.

To remedy the condition, *RTA* should first verify the existence of the scale, and remove it by either mechanical or chemical means.

Cliffside Park, N. J. A Di Lorenzo

Contaminated Water Causes Tube Trouble

The bowed tubes in *RTA's* hrt boiler appear to be caused by overheating as result of heavy and hard scale formation on water side of tubes. Forward section only has been bowed because greater precipitation of scale occurred there. If the boiler has been in operation some time and previous water treatment and cleaning methods have kept it free of scale and slag I think trouble has arisen from a sudden contamination of makeup water, especially if water supply is taken from a river.

To eliminate trouble of this kind, I suggest that *RTA* hire a good water-treatment expert.

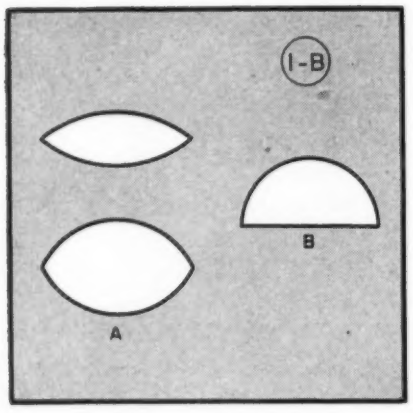
Montreal, Que. Arthur Belton

Good Circulation Will Help Bowed Boiler Tubes

I think tubes in *RTA's* boiler have been overheated. There may be a lot of mud around them where they are bowed. Feedwater may have caused scale to build up.

If the boiler has been low on water, tubes would have bowed from one end to the other. Therefore I believe something is wrong with the circulation of the water in the boiler. Feedwater pipe is not shown. Its location is important for good circulation. It should be connected on the side near place where tubes are bowed.

Tuscaloosa, Ala. E B Clements



Check Flyash in Tubes

Is RTA SURE that the tubes are bowed? They may be partly blocked with flyash. A bowed tube would give a light pattern as at *A*, sketch 1-*B*, while a flyash deposit would give a half circle pattern, as at *B*.

Pueblo, Colo. A L CARTER

Blowdown Misses Scale

EXCEPTIONALLY HARD WATER is the kernel of *RTA's* trouble. Referring to drawing 1-*C*, shaded area on forward sheet of boiler and along tubes is scale deposit. Collection of sludge as shown results from failure to create enough suction in this area when blowing down boiler. Arrows show flow during blowdown, which indicates impossibility of dislodging sludge deposit from day to day.

With deposits as shown, tubes become overheated, so a sag develops when tubes expand.

Quincy, Fla. D J PARMER

Shell Is Tapered

I BELIEVE BOWING of boiler tubes is caused either by poorly controlled firing or a badly constructed shell. As *RTA* does not say whether boiler is oil, gas, or coal fired it is hard to explain the trouble. I assume, however, that the obvious remedies have all been tried and have failed; I therefore believe trouble lies in the firebox, not in the shell.

Another explanation is that shell may be slightly tapered toward the base. This could be caused by either a construction or repair fault. Sketch 1-*D* shows what I mean. This is perhaps an unusual fault, but it is a possible explanation.

Auburn, N. Y. T E CONNOR

How Can We Get More Load on Our Generator?

(This is Question 2 from the December issue, with best answers from readers.)

We have a 5000-kva 4000-v 725-amp, 80%-pf 3-phase 4-wire 60-cycle 327-rpm vertical generator driven by a 5900-hp 50-psi constant-pressure waterwheel. Generator voltage is 4250 v at 97% lagging to 96% leading power factor. Excitation voltage is 60 to 80 v with current ranging from 120 to 160 amp. Exciter rheostat is in series with a conventional voltage regulator.

At present we are unable to get more than 4100 kw from this generator. Is the trouble with the prime mover, which runs wide open at this load? Or could the power factor or voltage at which load is carried cause the difficulty? It seems to me we should get full rated output from the machine.—JAL

Machine Is Doing Fine

SINCE JAL'S GENERATOR has a 5000-kva rating at 80% power factor, the actual power rating would be 4000 kw. With 5900-hp input, his machine efficiency is about 90%. At increased power factor, the apparent power would decrease because of a reduction in wattless current. Since this does not affect the power output, his machine is apparently giving satisfactory service with a 2.5% overload.

Muskegon, Mich. R H FREYE

Waterwheel Is Too Small

THE WATERWHEEL DOES NOT have sufficient capacity to carry rated load on generator. A rating of 5900 hp on waterwheel is equivalent to 4400-kw input to the generator, which has certain electrical and magnetic losses, as well as friction and windage. If these losses totaled 7% at full load the 5900 hp produced by the waterwheel would be reduced to 4100 kw at the generator terminals. This is confirmed by observation that the prime mover runs wide open. Output of the generator is limited by power that waterwheel can develop, and no change of voltage or power factor can get more power out of the generator than it receives from the waterwheel.

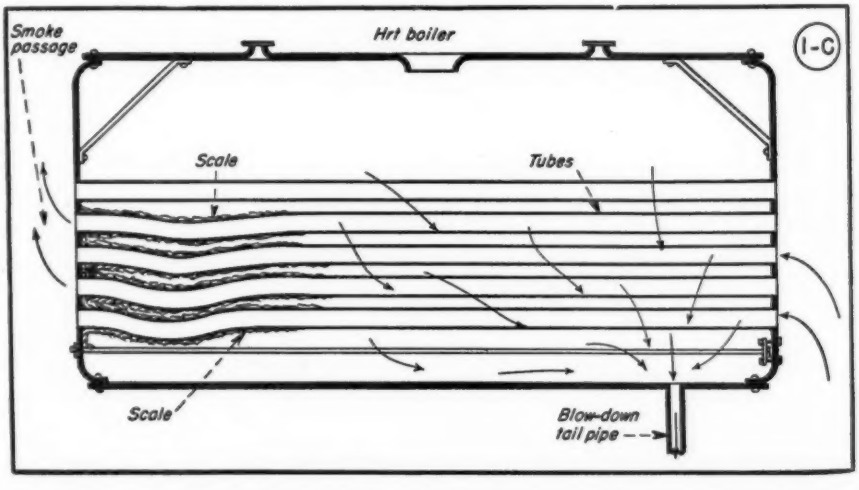
Tulsa, Okla. J R MISENHEIMER

Check Flow of Water

JAL LEAVES MUCH to the reader's imagination. He does not state whether the generator-coil temperatures are running abnormally high, nor whether alternator is one of many others feeding a transmission system or is operating independently. It is therefore somewhat difficult to arrive at the trouble.

Taking for granted that the nameplate rating is correct the generator's full load is 4000 kw at 80% pf and 5000 kw at unity pf. Referred to turbine output, 5900 hp is equivalent to about 4400 kw, or a difference of 4400 − 4000 = 400 kw—a reasonable value for losses inherent in the complete unit. Actual output is 4100 kw, which indicates a unit loss of only 300 kw, or that turbine is carrying a small overload. When hydraulic conditions are ideal a unit will sometimes produce more than rated capacity if it is in good mechanical condition.

Apparently at some previous time it has been possible to carry a greater load on unit. I suggest that *JAL* take the unit out of service at the earliest opportunity and give the prime mover a thorough inspection for worn buckets or blading, or a faulty casing. It is possible that some obstruction prevents



proper flow of water through the guide vanes. Water level in the tailrace would also have considerable bearing on the trouble.

Duluth, Minn. E R WEBBER

Check Alternator Efficiency

JAL CANNOT EXPECT to get much more power from his alternator unless he can increase power delivered by prime mover. Output of generator is given as 4100 kw. This is equivalent to 5500 hp, which is approximately 93% of the rated output of turbine. This indicates that his turbine is operating at full-rated capacity of 5900 hp and generator is operating at 93% efficiency, which sounds reasonable.

Because of high power factor of electrical load and generator rating of 5000 kva at 80% pf, *JAL* is correct in thinking the alternator is capable of more output. Increasing the voltage from 4000 to 4250 should cause no difficulty.

I suggest that *JAL* consult the manufacturer to determine what the efficiency of the alternator should be at full load for further check.

St Clair Shores, Mich. M H ELKIN

Water Turbine Is Normal

THE WATER-TURBINE GOVERNOR of *JAL's* machine is adjusted to maintain speed within specified limits. Water-turbine power is influenced by water pressure and wheel speed. Of these variables, wheel speed should not be changed or the electrical frequency would become non-standard. The other variable may be beyond *JAL's* control because it entails considerable expense.

At the rated supply head, and with open gates, water turbine is rated at 5900 hp at 327 rpm. This 5900 hp is equivalent to 4400 kw.

JAL says he gets 4100 kw out of his alternator when the gates are wide open on the turbine. The conversion efficiency from shaft power to electrical output figures out to 93.2%, which is quite normal. The 6.8% loss is consumed by the exciter, windage, copper and core losses, etc.

Brooklyn, N. Y. SAM ULANOWSKY

Investigate Water Passage

JAL BRINGS OUT an interesting point, which merits attention of many power-plant operating men. Two fundamental points apply to all generators: (1) Operator always has control of water supply to prime mover, and thus can adjust load on generator. (2) He can also adjust his alternator field excitation, but kilowatts delivered always remain the same.

If *JAL* wants more kw from his generator he must look to his prime mover which, he indicates, is running wide open. Generator is delivering 4100 kw. His prime mover is rated 5900 hp or 4400 kw.

If a waterwheel delivers subnormal power output, the cause is in its adjustment or setting. Invariably, high water velocities or incorrect passage through pentstocks, wheel case, discharge case or draft tube has resulted in deficient power output. This bears investigation.

If, on the other hand, *JAL* is considering the rating of his machine on the basis of the kw output of his generator, he is obtaining satisfactory output at nearly unity power factor.

Tenafly, N. J. K B HOFFMAN

Examine Turbine Runner

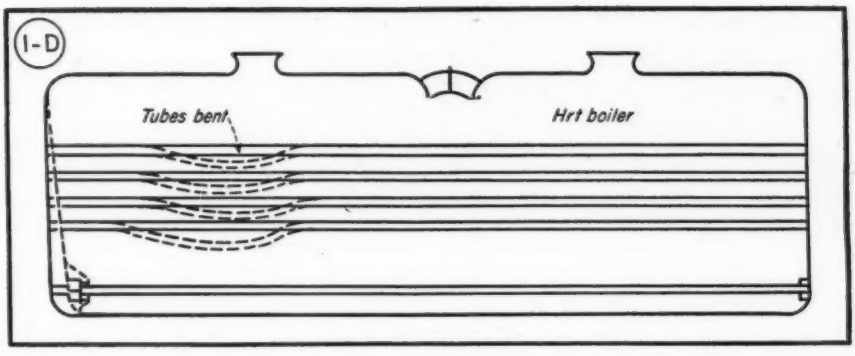
JAL STATES THAT the prime mover runs wide open, which indicates this as the source of trouble. The machine develops 4100 kw, or 5496 hp, 93% of rating.

Did the unit originally carry its rated load, then gradually taper off to its present condition? If so, that could indicate erosion of the blades that may be rebuilt by welding or metalizing.

Several other conditions could cause the loss in capacity, such as high tailwater, an air leak into the draft-tube, an obstruction in the draft-tube outlet, or possibly a foreign object lodged in the runner.

The electrical conditions as given are well below rated capacity, and nothing indicates trouble there. The generator voltage is about 6% higher than nameplate rating, but the power factor is very good for that voltage. The 4100 kw at 96% pf is 4270 kva, or about 580 amp per phase in the armature, as against 5000-kva and 725-amp rating.

Duluth, Minn. G I SMITH



Wheel Is Fully Loaded

HORSEPOWER OUTPUT of the waterwheel with 4100 kw load on the generator is about 5720 hp, assuming 96% as probable efficiency.

Excitation load, assuming the exciter is direct-connected, would require about 20 hp so total output of the waterwheel is 5740 hp.

The turbine is developing over 97% of its rated output. Hydraulic conditions should be checked to make sure the wheel is operating at its specified head. The wattmeter should also be checked. If everything is OK the runner should be examined for pitting, etc.

Voltage and power factors stated have no appreciable effect on the hp required. A point worth mentioning is that waterwheels are rated in hp. This rating is usually maximum output under a specified head. In *JAL's* case the machine is delivering over 97% of rating. While his generator could deliver a higher kw load at the stated power factors the waterwheel is very near its maximum output.

Hamilton, Ont. J A CAULDEN

7000-Hp Turbine Needed

IT WOULD SEEM that *JAL* is getting all the output from his generator that he can expect with his present installation.

His 4100 kw equals 5495 hp. He can assume 5% for the generator losses. This will be about 275 hp.

He does not state whether the exciter is driven by the generator. If so, he can add another 20 hp, which make a total of 5790 hp. If the turbine is old there may be some wear on the speed rings, runner, and guide vanes, so the turbine does not develop its rated output.

To get the full generator output would require a turbine of at least 7000-hp rating.

St. Raphael, Que. A ST. LAURENT

(*Continued on page* 154)

RECIPROCATING-PUMP Q&A FOR POWER ENGINEERS

By E F WRIGHT

6—Power-Pump Characteristics

In the sixth of a series, E F Wright, chief engineer, reciprocating pump division, Worthington, selects questions and answers that give practical understanding of construction, operation, characteristics, troubles and remedies.

Q 1—What are the primary advantages of power pumps?

A—Primary advantages are:

a. High efficiency. At or near full load large power pumps attain an over-all efficiency in excess of 90%. Even in the smaller sizes efficiency is rarely less than 80%. With a reasonable amount of attention to the condition of valves and plunger packing these efficiencies may be maintained indefinitely since normal wear does not result in gradually increasing internal leakage.

b. Ability to develop high pressures, even at small capacities, without materially reducing efficiency.

c. Simplicity and reliability. Modern self-oiling power pumps may be run for long periods with a minimum of attention.

d. Applicability to viscous liquids. Viscosities up to 2500 ssu have little effect on power-pump performance. Moderate-speed pumps operate satisfactorily up to 10,000 ssu and special low-speed pumps are built to handle liquids having a viscosity as high as 100,000 ssu.

Q 2—Through what range of capacity and pressure are power pumps applicable?

A—Small power pumps are applicable from moderate to the highest pressures. Small power pumps have been built for 10,000 to 15,000 psi, and pumps for 10 to 12 gpm are being constructed for higher pressures. In small power plants and marine installations, motor-driven reciprocating boiler-feed pumps gain in advantage as operating pressures rise above 450 psi. Power pumps serving hydraulic presses and shears operating at 4500 to 6000 psi and requiring 1200-hp drivers were built for war plants. Modern reciprocating oil-pipe line pumps are built for 1200 to 1800 gpm and 800 to 1200 psi. The large moderate-pressure power pump of 30 years ago has been replaced by the centrifugal pump, but as capacities are reduced and pressures increased, the power pump becomes more and more applicable.

Q 3—What volumetric efficiency is attained by power pumps?

A—Most power pumps have a volumetric efficiency of 96 to 98% as long as valves and packing are in reasonably good condition. As pump speed is increased, more attention must be given to valve action and to the valve spring loading. While delivery of each plunger drops gradually to zero as the end of the stroke is approached, instant reversal makes it necessary to load the valves sufficiently to bring them almost to their seat at the end of the stroke. If this is not done, considerable back flow or slip results, and considerable shock accompanies valve seating.

Packing leakage from outside-packed plunger pumps is readily noticeable and is easily kept under control, but packed-piston pumps require more care to insure against abnormal packing leakage. At extremely high pressures, fluid compression may reduce volumetric efficiency considerably unless special attention is given in the design to keep the clearance at a minimum.

Q 4—Does volumetric efficiency have a direct influence on the overall efficiency of a power pump?

A—Loss in volumetric efficiency due to slip of valves and packing directly influences over-all efficiency. At higher pressures and with certain fluids such as the lighter oils, fluid compression has a marked influence on volumetric efficiency. While some of the work of fluid compression is lost in heat, most of it is recovered during expansion at the start of the suction stroke, and hence it has relatively little influence on over-all efficiency. One maker of a small high-pressure oil pump having a relatively large clearance volume publishes test curves showing over-all efficiency about 30% greater than volumetric efficiency at full pressure.

Q 5—Can we say that a power pump has definite operating characteristics?

A—Yes. Each type of power pump has certain flow and acceleration char-

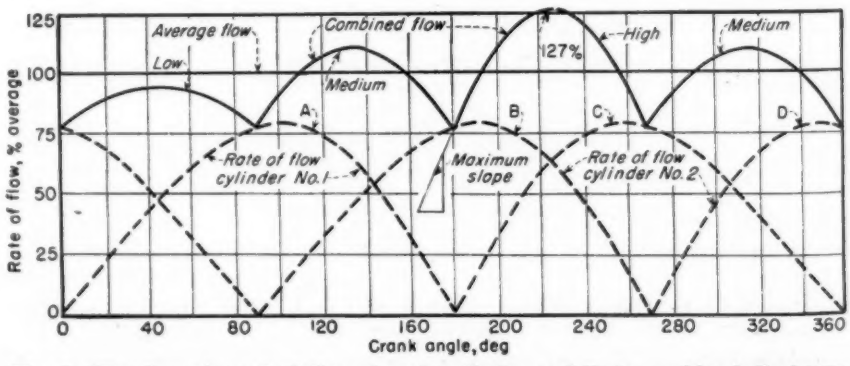
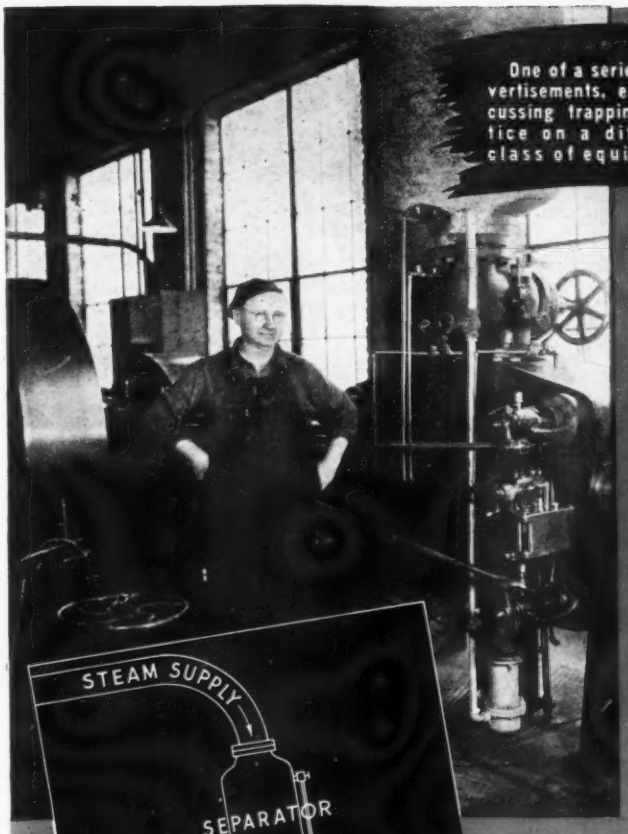


Fig. 1—The flow characteristics of each cylinder and their combined discharge curve, for a double-acting duplex power pump when cranks are displaced 90 deg

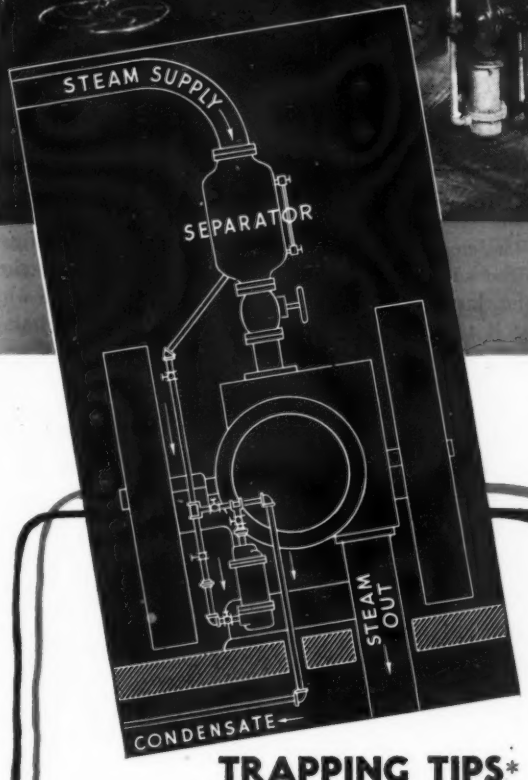


One of a series of advertisements, each discussing trapping practice on a different class of equipment.

No. 223 Armstrong Special Trap draining engine separator, Kerber Packing Co., Elgin, Ill.

HOW TO TRAP STEAM ENGINE SEPARATORS

Special Armstrong Traps for Pulsating Pressures



THE PRESSURE pulsations set up by reciprocating steam engines present an extra hazard for the trap that drains the steam separator ahead of the engine. Armstrong offers two types of traps for this service.

Where the pressure pulsations are extremely rapid or when there is a wide swing between maximum and minimum pressure, use a standard trap equipped with internal check valve and extra heavy spring. The check valve will maintain practically constant pressure in the trap body, thereby minimizing wear on the trap mechanism.

If the pressure pulsations are moderate and not too rapid, use the 220 series trap in semi-steel for pressures up to 250 lbs., or the 320 series steel traps for pressures to 600 lbs. The 220 and 320 series traps have a separating chamber below the trap body for collecting condensate. When the chamber is full, a float check permits all the condensate to enter the trap proper and produce a wide-open discharge at rather long intervals even though a little water will enter the separator every time the pressure rises.

For complete information or specific recommendations see your local Armstrong representative, or write the ARMSTRONG MACHINE WORKS, 812 Maple St., Three Rivers, Michigan.

TRAPPING TIPS*

- Install trap below and close to separator.
- Avoid use of extended horizontal lines ahead of the trap.
- When throttle valve of engine is closed, keep line to trap open to prevent accumulation of condensate.
- Install trap with bypass.

*For complete data on condensate loads, trap safety factors and trap installation, ask for a copy of 36-page CATALOG H.

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PUMP Q&A

Continued

acteristics, which are modified to some extent by details of design, but which are not changed by the piping and other features of the rest of the pumping system. A direct-acting steam pump adapts itself to some extent to the characteristics of the entire pumping system. A power pump has no such flexibility and labors to make flow in the entire system correspond to its particular flow pattern, except where adequate cushion chambers may be used on both suction and discharge of the pump. While the flow pattern of a pump cannot be changed, its influence on a given piping system is subject to simple analysis to determine whether cushion chambers must be used or the piping modified to suit pump characteristics.

Q 6—What are the flow characteristics of a double-acting duplex power pump?

A—Fig. 1 shows how the velocity and hence the rate of displacement or flow from the individual plungers resembles the sine curve of simple harmonic motion, but is distorted by the effect of the moderate length connecting rod. Amount of this distortion is decreased as the ratio of connecting rod length to crank radius is increased. As plotted, curves *A* and *B* lean to the right and *C* and *D* to the left. This causes the periodic variation in the combined velocity or flow curve which has four peaks: low, medium, high and medium.

Q 7—What are the flow characteristics of single-acting triplex and quintuplex power pumps?

A—Fig. 2 and 3 show the flow curves for these pumps. Since they are single-acting all the curves of the individual plungers lean in the same direction and there is no variation in peak flow, as for a double-acting duplex pump, Fig. 1. Instead, an identical variation in flow is repeated three and five times per revolution. Because of the incomplete overlapping of strokes half of the combined curve of the triplex pump is the sum of two individual curves, *A* to *B*, and half is the peak of an individual curve, *B* to *C*. The quintuplex combined curve is the sum of the first three, *A* to *B*, and then two individual curves, *B* to *C*.

Q 8—Is the variation in flow rate during each cycle of primary importance in comparing the characteristics of different power pumps?

A—No. Usually the *rate of change* in flow or velocity rather than the *amount of change* is responsible for pressure fluctuation. The maximum rate of change in velocity is proportional to the product of the pump speed and a factor representing the greatest slope of the combined velocity curve. Fig. 1, 2 and 3 show that the maximum slope of the double-acting duplex curve is almost twice that of the triplex curve, which in turn is less than twice as steep as the quintuplex curve. For pumps of the different types having the same capacity at the same speed, pressure fluctuation will be in this proportion. This is true except in the unusual case of a pump discharging through a short length of pipe and a nozzle, where the pressure varies as the square of flow variation.

Q 9—Will a small, high-speed power pump cause less pulsation in pressure than a larger low-speed pump of the same type and capacity?

A—No, at least within the speed range of pumps now in use. The small pump at a higher speed has the same total variation in flow as the larger pump with the difference that it takes place more frequently. Thus the *rate of change* is greater for the small, high-speed pump, and in the average system where the inertia of the associated fluid column is important, the fluctuation in pressure will be greater.

Q 10—Are all power pumps capable of operating with a suction lift?

A—No. Suction requirements vary widely with design and service for which the pumps are intended. Piston pumps for low and moderate pressures are usually capable of operating with a suction lift of 10 to 20 ft of water, depending on the speed and relative valve area. Horizontal duplex side-pot pumps are usually offered with considerable range of liner and piston sizes for each size of pump cylinder. Thus with a small liner and piston, the valve area is relatively large and a higher suction lift is permissible. With the largest liner and piston for a given cylinder, the relative valve area is less and hence the pump must be operated with less suction lift.

Q 11—Are all power pumps self priming with a suction lift?

A—No. This depends on the clearance volume and on the required valve loading. Moderate-speed piston pumps for operation at moderate pressures are usually self-priming with some suction lift. If the clearance volume is filled with liquid the pump should be self-priming at any reasonable operating lift. Where priming is no problem, plunger pumps for higher pressures are usually designed to operate with flooded suction.

(*Continued on page* 142)

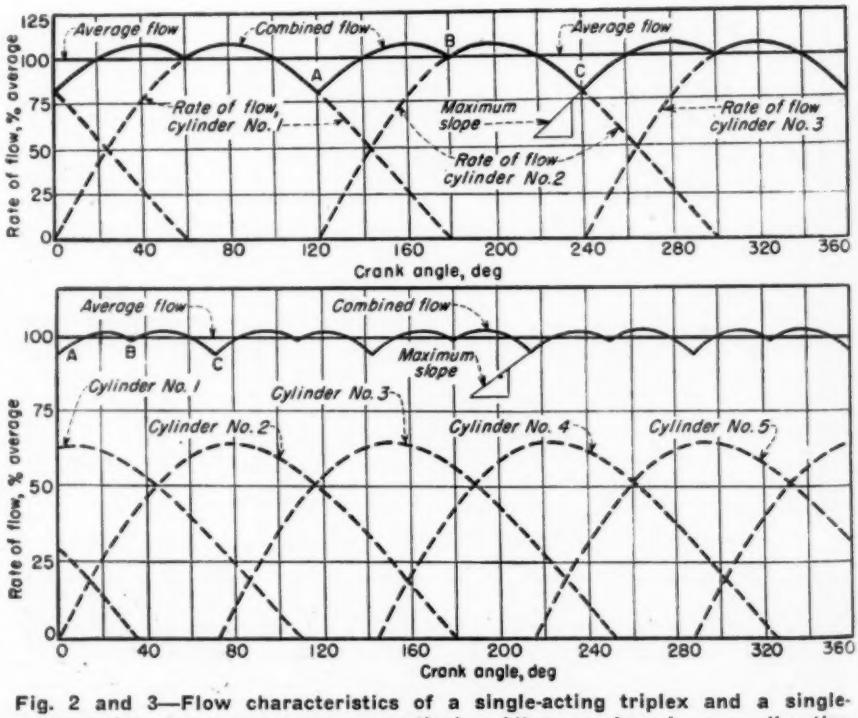

Fig. 2 and 3—Flow characteristics of a single-acting triplex and a single-acting quintuplex power pump, respectively. All curves lean in same direction

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WATER-TREATMENT QUESTION BOX

HOW TO REMOVE WATER HARDNESS

By K M Herstein and John S G Shotwell

▶ THIS NINTH QUESTION in the water-treatment series discusses hardness in water, and how to remove it.

Goodwater Laboratory
Drum City, U. S. A.
Dear Chemist:

Will you explain what a chemist means by hard water, and how it can be made soft? Also please tell me how hardness affects boiler operation.

Yours truly,
Walter Tender

Dear Walter:

Your request reminds me of the student who answered your question with, "Hard water is water that is frozen; to soften hard water, heat it."

The term *hardness* comes from studies made on water for laundering purposes. Hard water requires a lot of soap to make a lather, while soft water requires little. Further complications result from terms *temporary* and *permanent* to designate hardness that can be removed by boiling and that which cannot. Both kinds may cause scale, and therefore must be removed.

The presence of dissolved salts of calcium and magnesium cause hardness. They are the basis of the more troublesome scale deposits and also a cause of difficulty in forming lather.

Temporary or carbonate hardness is measured in equivalent parts of calcium carbonate, although it is actually present in the bicarbonates of calcium and magnesium. Calcium or magnesium carbonate is practically insoluble in water, but if carbon dioxide is first dissolved in the water they become soluble, and remain so as long as an excess of CO_2 is in the water. When such a mixture is heated, the CO_2 is driven off and the carbonates fall out as a soft sludge, but this may, under the effect of heat and pressure form scale. Thus:

Limestone + water → no solution
Water + CO_2 → acid water
Acid water (CO_2) + Limestone → hard water
Hard water + heat → soft water + CO_2 + limestone

Chemically;

$$H_2O + CO_2 \rightarrow H_2CO_3 \text{ (carbonic acid)}$$

Limestone — Bicarbonate

$$CaCO_3 + H_2CO_3 \rightarrow CA(HCO_3)_2$$

Sludge — Gas off

$$Ca(HCO_3)_2 + \text{heat} \rightarrow CACO_3 + H_2O + CO_2$$

Carbonate hardness can cause deposits in heater and feed lines as well as in the drum. If these are objectionable some form of pre-external treatment must be used, but if not, internal treatment may be the problem's solution.

Permanent or sulphate hardness is caused by the presence of calcium or magnesium sulphates. These do not break down with heat and fall out of solution as do the carbonates, but are deposited with them through becoming concentrates by the continuous evaporation of water in the boiler. The mixture of sulphates and carbonates cement together to form a hard scale. Sulphate hardness must be treated because of its cementing action. The object of this treatment is to form a loose sludge rather than hard scale. Such treatment may be purely chemical or partly mechanical, as in colloids.

Simplest treatment uses soda ash (sodium carbonate), which changes partners with the calcium and magnesium sulphates to produce sodium sulphate in solution and calcium or magnesium carbonates as soft sludge. This treatment, however, can be used only in low-pressure boilers as soda ash breaks down into caustic soda and CO_2 at high temperatures. Other chemicals accomplish the same result and do other desirable jobs as well without producing caustic soda. Phosphates, for instance, first act on the sulphates and then on any other calcium or magnesium compounds present and insure that no scale-forming salts remain.

Sodium aluminate acts as a coagulant within the boiler drum to form a loose sludge. It also acts on any silica present to prevent it cementing the the sludge particles into a hard scale.

Usual hardness test is to titrate one sample with standard soap solution *H* and another with sulphuric acid, using phenolphthalein *P* and methyl orange *M* indicator. *H* gives total hardness, both carbonate and sulphate; *P* gives free caustic and carbonates, but no bicarbonates. *M* gives the bicarbonates. Table shows relation between these three tests.

Yours truly,
Chemist
Goodwater Laboratory

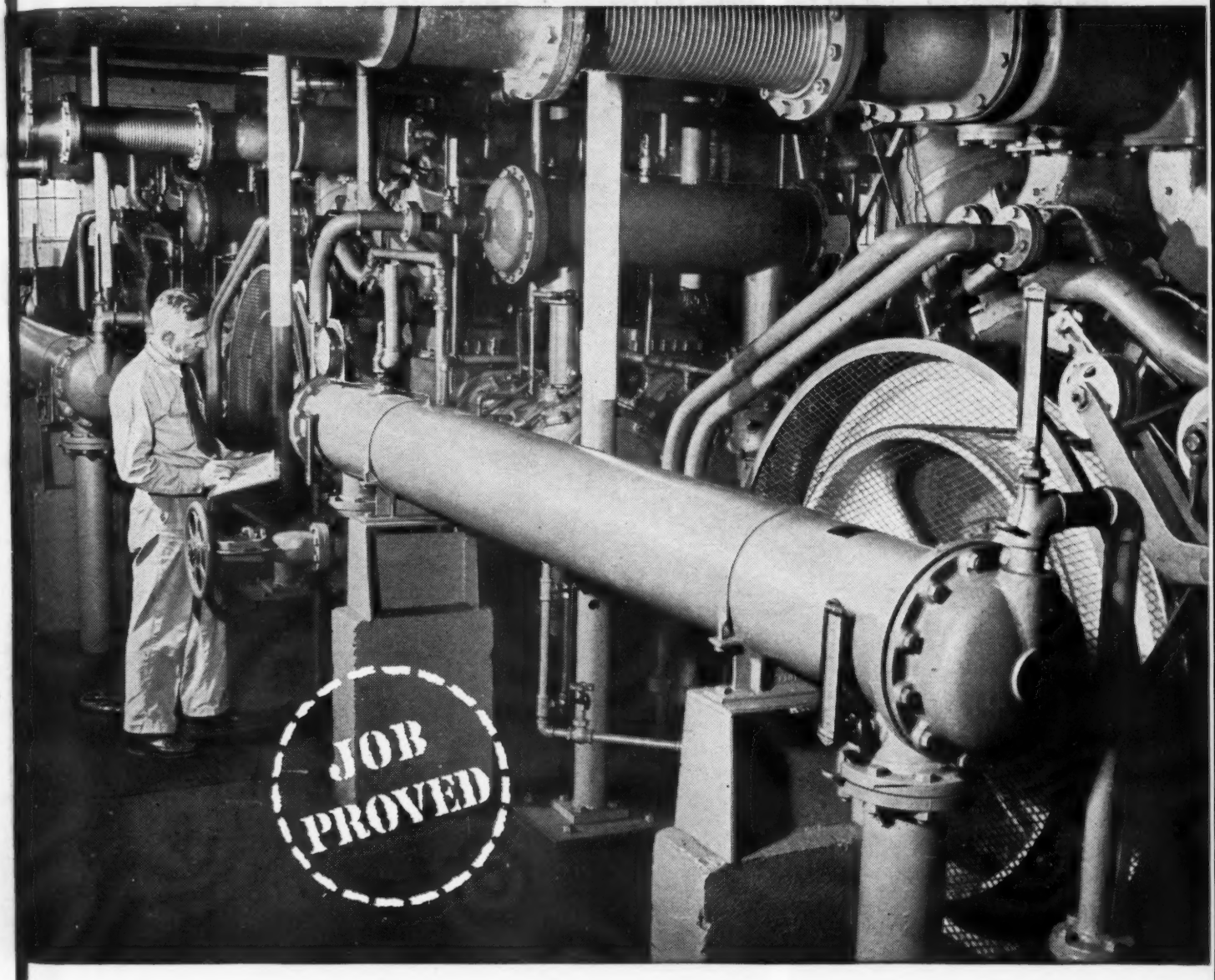
GENERAL RULES FOR INTERPRETING ANALYTICAL RESULTS FOR HARDNESS AND ALKALINITY

Compare value of *P* with that of *M*; then find corresponding condition in Column 1. Next, compare *M* with *H* and locate proper line in Column 2. Read across to find rules for figuring the results. All answers are given in ppm.

	WHEN:		THEN RELATIONS BELOW SHOULD HOLD:					
			Free	Carbo-	Bicarbonates		Hardness	
Condition	Column 1 *P* equals	Column 2 *H* equals	caustic OH	nates CO_3	Total	Sodium	Perma-nent	Tempo-rary
1	0	0	0	0	M	M	0	0
2	0	Less than M	0	0	M	M—H	0	H
3	0	M	0	0	M	0	0	H
4	0	More than M	0	0	M	0	H—M	M
5	Less than ½ M	0	0	2 P	M—2 P	M—2 P	0	0
6	Less than ½ M	Less than M—2 P	0	2 P	M—2 P	M—2 P—H	0	H
7	Less than ½ M	M—2 P	0	2 P	M—2 P	0	0	H
8	½ M	.....	0	2 P	0	0	0	0
9	More than ½ M	.....	2 P—M	2x(M—P)	0	0	0	0
10	M	.....	M	0	0	0	H	0

Legend: *H* = hardness, expressed as ppm calcium carbonate
P = phenolphthalein alkalinity, expressed as ppm calcium carbonate
M = methyl-orange alkalinity, expressed as ppm calcium carbonate

Compressing Maintenance Problems



SUN COMPRESSOR LUBRICANT...

Keeps Compressors Operating Four Years on 24-Hour-a-Day Schedule

Twenty thousand and ten hours of trouble-free operation were piled up by one unit in a big, industrial plant operating a battery of heavy-duty 400 horsepower compressors. There was no time out except for routine inspections. Sun Oil was used from the very first hour these compressors were installed. When they were finally shut down for major overhauls, no wear was apparent and no major parts had to be replaced.

Sun "Job Proved" industrial lubricants are making similar impressive records in all kinds of industrial plants, keeping production on an even, round-the-clock basis, holding down maintenance and operating costs. If you have problems concerning the lubrication of compressors, power plants, machine tools or other industrial equipment — remember the Sun Engineer is at your service without obligation on your part. Just phone the nearest Sun office or write Dept. P-2 . . .

SUN OIL COMPANY · ***Philadelphia 3, Pa.***

Sponsors of the Sunoco News-Voice of the Air — Lowell Thomas

SUN

SUNOCO

INDUSTRIAL PRODUCTS

HOW TO ATTACH CARBIDE TIPS TO TOOLS

▶ TUNGSTEN CARBIDE, composed of tungsten and carbon, is almost as hard as a diamond. It is produced by carbonizing incandescent tungsten in methane or hydrocarbon vapor, or by heating tungsten powder and carbon in a furnace. The briquetted and sintered product, harder than any commercial steel, is used as an abrasive and for high-speed cutting of metal and other hard materials. Small amounts of titanium carbide added to cemented tungsten carbide give it greater cutting efficiency. Cutting tools made from tungsten carbide withstand cutting speeds from three to ten times those permissible with high-speed steel but will not withstand shocks. Therefore the tungsten carbide should be backed up by tougher and more ductile metal. The photographs explain how to silver-braze a tungsten-carbide cutting tip to a recessed tool shank. Method produces a hard, strong cutting tool.

1 Recess the tool shank to fit the carbide tip. Cover all sides of joint with pieces of sheet brazing alloys, cut slightly oversize. Even small traces of oil, grease or oxide may prevent making a good bond so clean the tip and recess by grinding the surfaces. Flush the surfaces and brazing strips with carbon tetrachloride

2 Thorough fluxing is essential because it dissolves oxides formed during heating, and helps brazing alloy to wet the surfaces. With small brush or applicator, cover surfaces of tip, tool-shank recess, and alloy strips with liberal coating of flux. Place parts in position for brazing and again coat them liberally with flux

3 Adjust oxyacetylene torch to give nonoxidizing flame, indicated by greenish feather at tip of blue inner cone. Heat shank from below, and keep flame moving back and forth. While alloy melts at 1270 F, heat shank to about 1400 as carbide tip must be heated by conduction

Photos, courtesy of Handy & Harman

4 Watch the brazing alloy and when it melts apply moving flame momentarily to carbide tip. When alloy is completely molten, move tip around slightly with previously warmed rod to make sure alloy wets tip and shank surfaces completely. (A cold rod may crack carbide tip.)

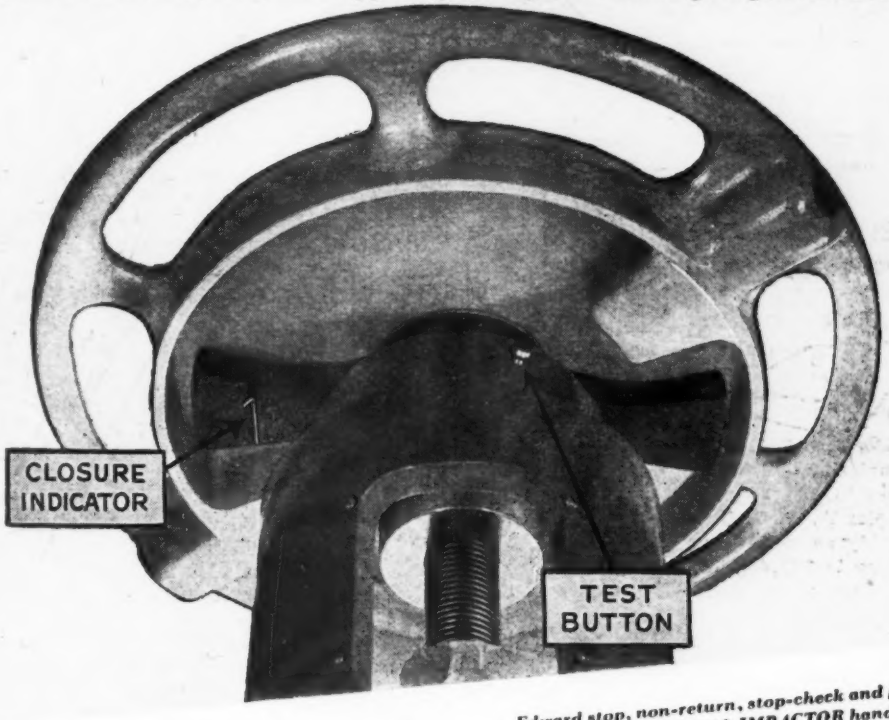
5 Remove the flame and hold the tip in position under slight pressure with the holding rod until the alloy sets. Remove from the vice, and place in powdered asbestos, mica or lime until cool to prevent the tip cracking. Do not cool by quenching. When cool, wash off the flux

AN EDWARD CONTRIBUTION TO BETTER VALVE PERFORMANCE—THE IMPACTOR HANDWHEEL

How the *Edward* Impactor Handwheel closes big valves in little spaces

Where great torque is necessary to close a valve against high pressures —particularly in cramped areas— no operating device is as effective as the Edward IMPACTOR handwheel.

The IMPACTOR handwheel, an exclusive and patented Edward development, sees to it that a valve shuts tight against extreme pressures without extension levers, gear series, cumbersome toggle tops, or space-stealing large diameter wheels.



Notice—

- how the two heavy lugs, cast integrally with the wheel at 180°, strike simultaneous hammer-blows on the cross arm attached to the stem —making a positive shut-off.
- ample strength for any operating emergency.
- closure indicator and test button.
- how simple and well balanced the whole mechanism is, how little space it takes up.

Edward IMPACTOR equipped valves, in most sizes, also have Edward patented EValthrust yoke bushing for additional thrust capacity and smooth operation.

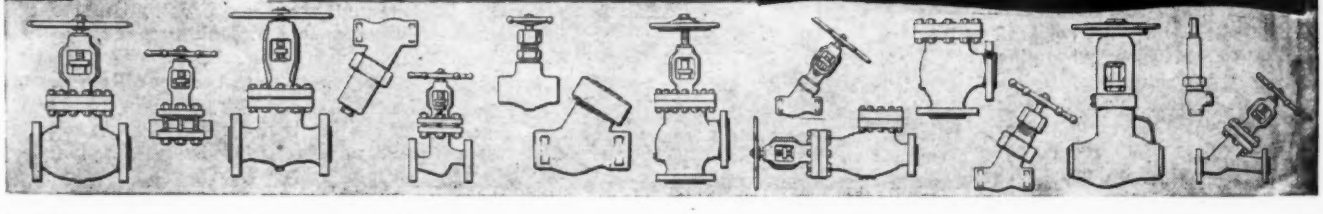
Edward stop, non-return, stop-check and gate valves are regularly furnished with IMPACTOR handwheels, in the following sizes and pressures:

5 in. and larger 1500 lb; 6 in. and larger 900 lb; 8 in. and larger 600 lb; 10 in. and larger 300 lb.

Edward Valves, Inc.

Subsidiary of Rockwell Manufacturing Company

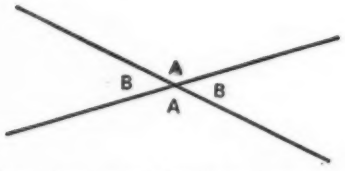
EAST CHICAGO, INDIANA



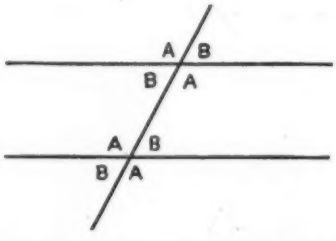
MATH TIPS

PHIL SWAIN GIVES HELPFUL HINTS TO EVERYDAY USERS OF NUMBERS AND HOMESPUN MATHEMATICS

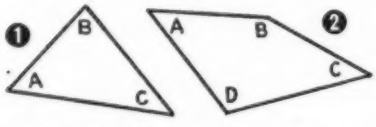
21—Useful Facts From Geometry: 1



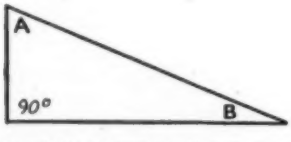
When two straight lines cross, the angles of the same letter are equal



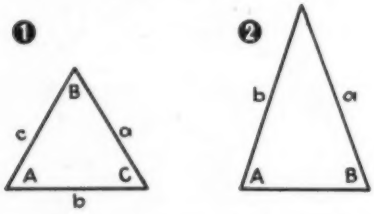
When a straight line crosses two parallel lines, the angles of the same letter are equal



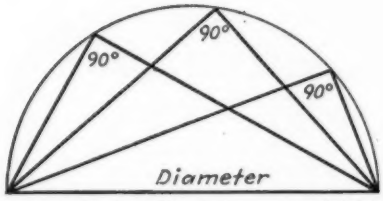
1 The interior angles, A, B, C of any triangle add up to 180 degrees. 2 The interior angles A, B, C, D of any quadrilateral (figure with four straight sides) add up to 360 degrees.



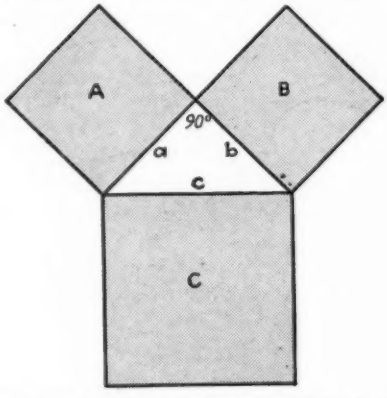
In any right triangle the two angles not right always add up to 90 degrees



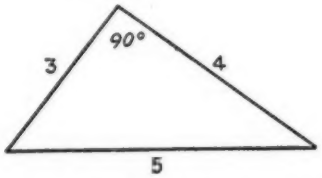
1 Any triangle with three equal angles, A, B, C, has three equal sides, a, b, c, and vice versa. Such triangles are called "equilateral." 2 Any triangle with two equal angles, A, B, has two equal sides, a, b, opposite the equal angles, and vice versa. Such triangles are called isosceles"



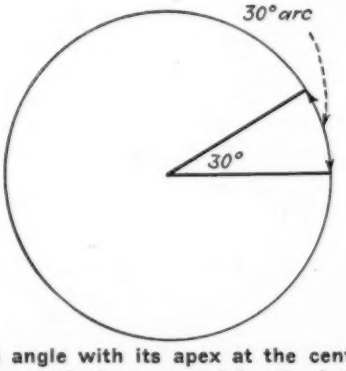
Any angle inscribed in a semicircle, as indicated here, is a right angle



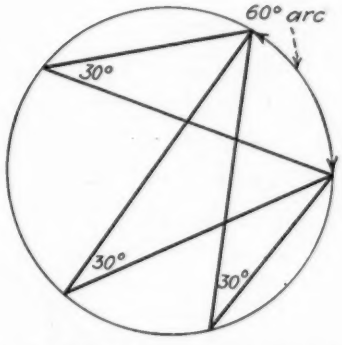
In any right triangle the square C on the hypotenuse equals A + B, sum of the squares on the legs. This holds either for the indicated areas or for the numerical squares of the sides, a, b, c. Thus, if a is 5 ft and b is 7 ft, c is $\sqrt{5x5 + 7x7} = \sqrt{25 + 49} = \sqrt{74} = 8.60$ feet



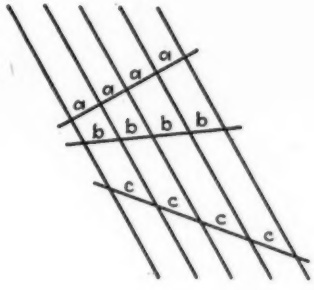
A triangle with sides proportional to 3, 4, 5 (say 3, 4, 5, or 6, 8, 10, or 9, 12, 15, or 30, 40, 50) will be a right triangle with the right angle between the 3 side and the 4 side. Proof: $3x3 + 4x4 = 5x5$



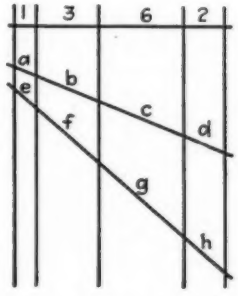
An angle with its apex at the center of a circle is measured by the intercepted arc. Thus, a 30-deg angle will intercept a 30-deg arc, and vice versa



An angle with its apex anywhere on the circumference of a circle will be half the arc intercepted on the circumference, and vice versa. Here, each 30-degree angle intercepts a 60-degree arc

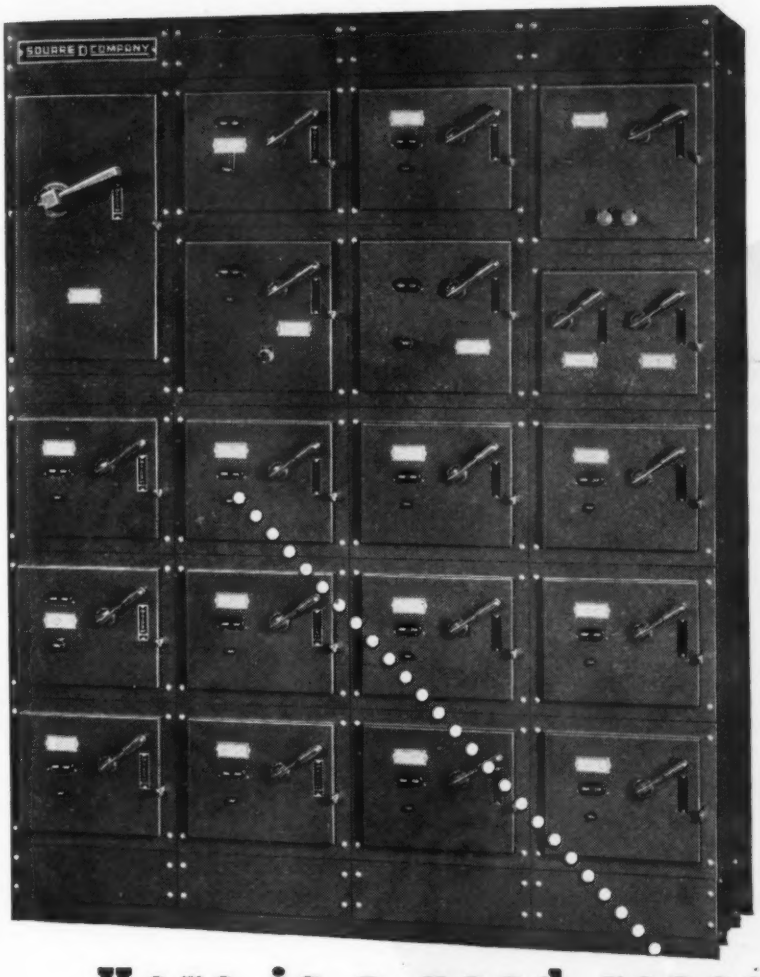


Equally spaced parallel lines will divide a line crossing them at any angle into equal parts. Thus if the a's are equal, the b's will be equal, and the c's will be equal.

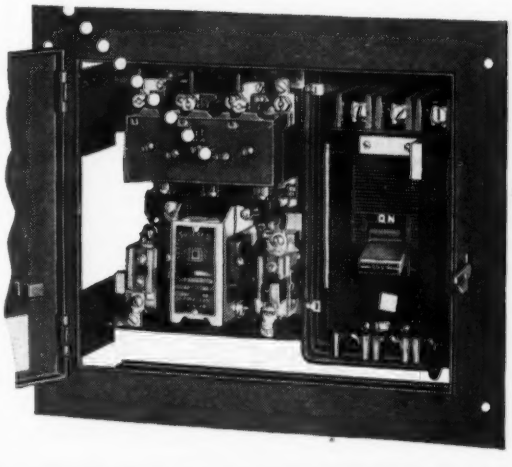


Unequally spaced parallel lines will divide a line crossing at any angle into segments proportional to the spaces between the parallel lines. Thus 1 is to 3 is to 6 is to 2 as a is to b is to c is to d or e is to f is to g is to h

A PART OF SQUARE D's PARADE OF NEW DESIGNS



Here is a good reason for specifying Square D CONTROL CENTERS



• Control centers permit low-cost grouping of starters in favorable locations. They offer the basic advantages of attractive appearance, compactness, easy installation, convenient maintenance and adaptability to future change or expansion.

You get better performance in Square D Control centers because each of the basic advantages is greatly increased by the time-proved design and operation of Square D Starters plus the inherent value of Circuit Breaker protection.

Call your nearby Square D Field Engineer for complete details.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

THE ARGUMENT CORNER

Dipping into our mailbag we find (1) suggested method of rating packaged steam generators (2) connecting two boilers of different pressures to headers (3) what kind of advice to get before buying a generator (4) distilled-water ice belongs in the horse-and-buggy days (5) compressed-air explosions solved

Method of Rating Packaged Generators

THE SPECIAL SECTION on "Steam Generation" in December 1946 POWER is extremely interesting and helpful but there are some points on which I believe additional information is desirable for the average user.

The description of the "packaged" steam generators shows their construction and characteristics, but does not bring out the fact that most such designs are "maximum rated"; that is, rated on a different basis than the 10 sq ft of heating surface per boiler horsepower, which has been the accepted basis for conventional firetube boilers.

To see what this means, suppose a nontechnical buyer asks quotations on an 80-hp boiler from the makers of hrt, 2-pass, firebox and packaged types. The prices he gets will be based on a boiler with 800 sq ft of heating surface for the hrt, 2-pass and firebox types. But for the packaged units the surface may be very much less, depending on the maximum capacity the maker has found can be obtained under test conditions.

Suppose that the unit to be purchased is to replace a 50-hp 2-pass oil-fired boiler which has proved too small for the load, and that the owner of the plant chooses as a replacement the packaged unit, being attracted by its low fuel consumption. The new unit will be capable of producing its rated output of 80 hp, but not much more than this, since it is rated at close to its maximum capacity. The boiler it replaces, on the other hand, could actually produce about 100 hp when pushed to its limit. Thus the new boiler, intended to increase plant capacity, actually does not do so and plant capacity may prove to be less. This not only can happen, but has happened.

This points up the fact that both the boiler horsepower and the square feet of heating surface are unreliable methods of rating boiler capacity. What the buyer really needs to know is the ability of the steam-generating unit to produce steam, measured in lb per hr. If comparisons of the kind cited in the example above are always reduced to lb of steam per hr, there is no danger of confusion.

In the description of bent-tube boilers with the drum axis parallel to the long axis of the boiler, pp 80-81, it was not made clear that the integral economizer applies only to the unit shown in Fig. 9, and is not a general characteristic of this boiler type. In my opinion, the value of this economizer section is questionable, particularly if the feedwater is not deaerated and contains dissolved oxygen or carbon dioxide.

WILLIAM W GAYLORD
Consulting Engineer
Hamden, Conn.

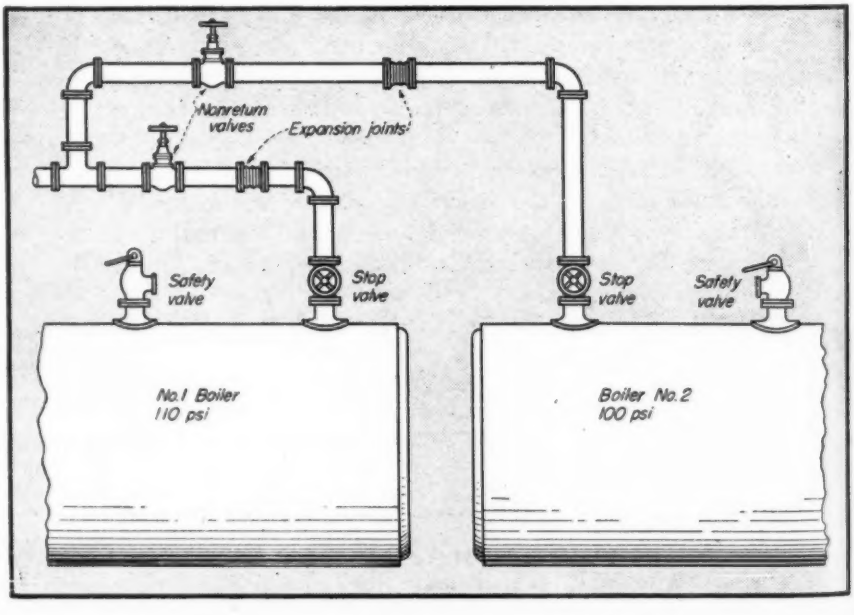
Connects Units of Different Pressures to Header

AFTER READING "Protecting Two Boilers of Different Pressures," by Harry M Spring, June, 1946, I would like to call attention to the way we handled a similar problem. About 18 months ago we installed a 100-psi boiler and connected it to the steam header with a 110-psi unit. Two gate valves were installed between each boiler and the steam header. When the boilers were inspected, before raising steam on the 100-psi unit, two inspectors requested installation of a nonreturn valve on each boiler before they would approve connecting them to the same header. The diagram shows how we connected the boilers.

This arrangement is ideal for us because if pressure drops to 100 psi the lower-pressure boiler cuts in automatically. When load falls to the capacity of one boiler steam pressure rises and the lower-pressure boiler is taken out of service. Control of this boiler is set to cut out both its burners when steam pressure exceeds 100 psi.

We need some steam and hot water in the plant during the cleanup period after the night engineer goes off duty.

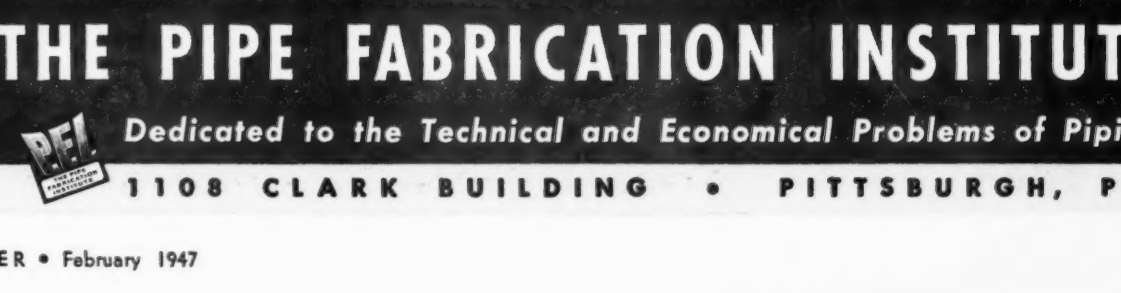
(*Continued on page* 144)



PRE-FABRICATED PIPING IS BETTER PIPING

Pre-fabricated piping is delivered to the job as a series of sub-assemblies that permit easy, rapid and economical installation. It is prepared in a plant employing experienced mechanics and pressure welders whose work can be insured. Layout tables, form cutting machines, work rotating fixtures, straightening tables, preheating and stress relieving equipment, testing facilities, etc. (not usually available in the field) offer further assurance of superior quality.

Specialized piping experience over many years enables the qualified fabricator to contribute suggestions which assure sub-assemblies that are commercially practical. Such sub-assemblies are shop tested, accurately aligned, thoroughly cleaned and inspected . . . all important to a satisfactory piping job.



THE PIPE FABRICATION INSTITUTE

Dedicated to the Technical and Economical Problems of Piping

5-6 1108 CLARK BUILDING • PITTSBURGH, PA.

WHAT'S NEW IN PLANT EQUIPMENT

Recording Rotameter

NEW RECORDER uses the *Dynalog* system of transmission by electronic high-frequency circuits. Recording system uses induction-bridge principle. Unit gives instantaneous response to flow and operates on continuous balance. Induction transmitter is available for recording rotor positions of many standard *SK Rotameter* designs, including the *Universal* and *Armored Rotameter*. **Dept P, Schutte & Koerting Co, 12th & Thompson St, Philadelphia 22.**

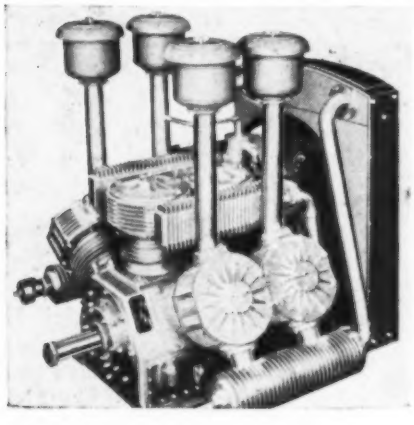
Tube Insert

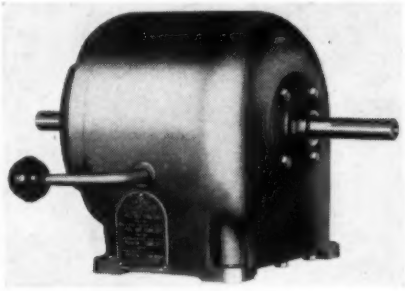
FIBRECLAD FLOWRITE CONDENSER-TUBE INSERT consists of a belled-end unbreakable metal tube with a thin fiber sleeve shrunk on the outside. No cement is required. Device is simply inserted into tube end. After contact with water fiber swells and produces a tight seal. *Fibreclad Flowrites* are available for any size tube in lengths to suit erosion problem of particular unit. **Dept P, Condenser Service & Engrg Co, Hoboken, N. J.**

Air Compressors

FIVE NEW AIR COMPRESSORS of 60- to 315-cfm capacity are of V-type cylinder design except the 315-cfm unit, which has four low-pressure and two high-pressure cylinders arranged in W formation. Cylinder heads, manifolds and crankcases are of aluminum alloy. Other features are: (1) double-row crankshaft ball bearings (2) forced-feed lubrication (3) individual air cleaners on each low-pressure cylinder.

Units are available in industrial, skid, steel-wheel, pneumatic-tired trailer, and flanged-wheel units for mine and railway work. **Dept P, Davey Compressor Co, Kent, Ohio.**





Gearshift Drives

GEARSHIFT DRIVES, designed to motorize machines requiring four selective speeds, can be used with any standard 0.25- to 1-hp motor. Gear ratios are 1 to 1, 1.33 to 1, 2 to 1, and 4 to 1, so speed change occurs in even steps. Permanent alignment is provided by unit-cast gearbox. Gears and bearings are bath lubricated. Shift lever is available in four positions, with speed-selection chart to facilitate choice of output speed. Unit operates in either direction. Small over-all dimensions adapt unit to applications where mounting space is limited. **Dept P, Lima Electric Motor Co, 7008 Findlay Rd, Lima, O.**

Welding Electrode

SHIELD ARC LH-70 WELDING ELECTRODE has a low-hydrogen, low-moisture coating and is for dc polarity. It greatly simplifies welding of high-sulphur free-machining steel and of certain high-tensile low-alloy steels. Welded properties are 70,000- to 80,000-psi tensile strength and elongation 25 to 30%.

New electrode eliminates or reduces preheating of high-tensile, low-alloy steels and welds of exceptional toughness can be made on high carbon and other steels. High-silicon electrical and high-sulphur steels can be welded as readily as low-sulphur mild steel. Electrode comes packed in 50-lb containers, size $\frac{1}{8}$, $\frac{5}{32}$, and $\frac{3}{16}$ in., in diameter, by 14 in., long. **Dept P, Lincoln Electric Co, Cleveland 1, Ohio.**

Protective Coatings

CONTROLLED, INDIRECT HEATING from an agitated oil bath of 100 to 550 F, coupled with a provision for rapid cooling gives, it is claimed, a means of changing viscosity of skin coating. A variable-speed mechanical agitation results from an air-powered ball-bearing turbine motor.

Built-in dial thermometer and thermostat with knob dials and pilot lights permit visible check of thermostatically controlled oil bath temperature in *Plast-O-Dip* tank models 5 and 5*E*. Added safety control uses a double thermostatic reaction as well as an automatically controlled cooling system. **Dept P, Aeroil Products Co, 5701 Park Ave, West New York, N. J.**

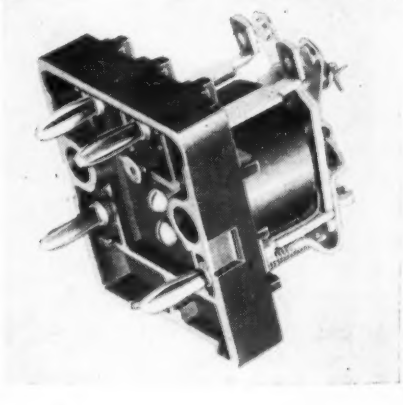
Pedestal Pump

NEW CAST-IRON bronze-fitted pedestal centrifugal pump comes in three sizes: 1x1 in., 2x2 in., and 3x3 in. Capacities are from 10 to 500 gpm, 10- to 100-ft head and 0.25 to 15 hp. Designed for V-belt drives they give wide range of capacities according to sheave size and power unit. All pumps have maximum diameter impellers, capacity variations being obtained by changes in sheave size to change speed.

The compact pumps operate in any position, which makes them suited to many applications. Keyed to shaft and held with locknut, open impeller handles liquids containing considerable solids. A mechanical seal replaces conventional packing, lantern ring and valve. Bearings are of ample size for either direct or belt drive. Pump, baseplate, motor and V-belt are supplied as a unit, or parts can be purchased separately. **Dept P, Allis-Chalmers Mfg Co, Milwaukee, Wis.**

Midget Relay

A MIDGET MAGNETIC RELAY, known as *Bulletin* 106, is designed for applications in industrial, electronic and special control circuits where remote or automatic operation is required. Suitable for ac or dc on



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Easier way to better piping
...CRANE Supplies Everything

Why do it the hard way when you can simplify every step of piping jobs—from design to erection to maintenance work. Specify Crane equipment—the truly complete line that not only includes everything you need, but assures the quality you want in every item.

This air service piping system, for example, shows the 3-way advantage of standardizing on the complete Crane line—

ONE SOURCE OF SUPPLY gives you the world's most complete selection of valves, fittings, pipe, accessories and fabricated piping for all power, process, and general service applications. One order covers everything for the job.

ONE RESPONSIBILITY for piping materials helps you to get the best installation and to avoid needless delays on jobs.

OUTSTANDING QUALITY in every item assures uniformly high performance in every part of piping systems.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
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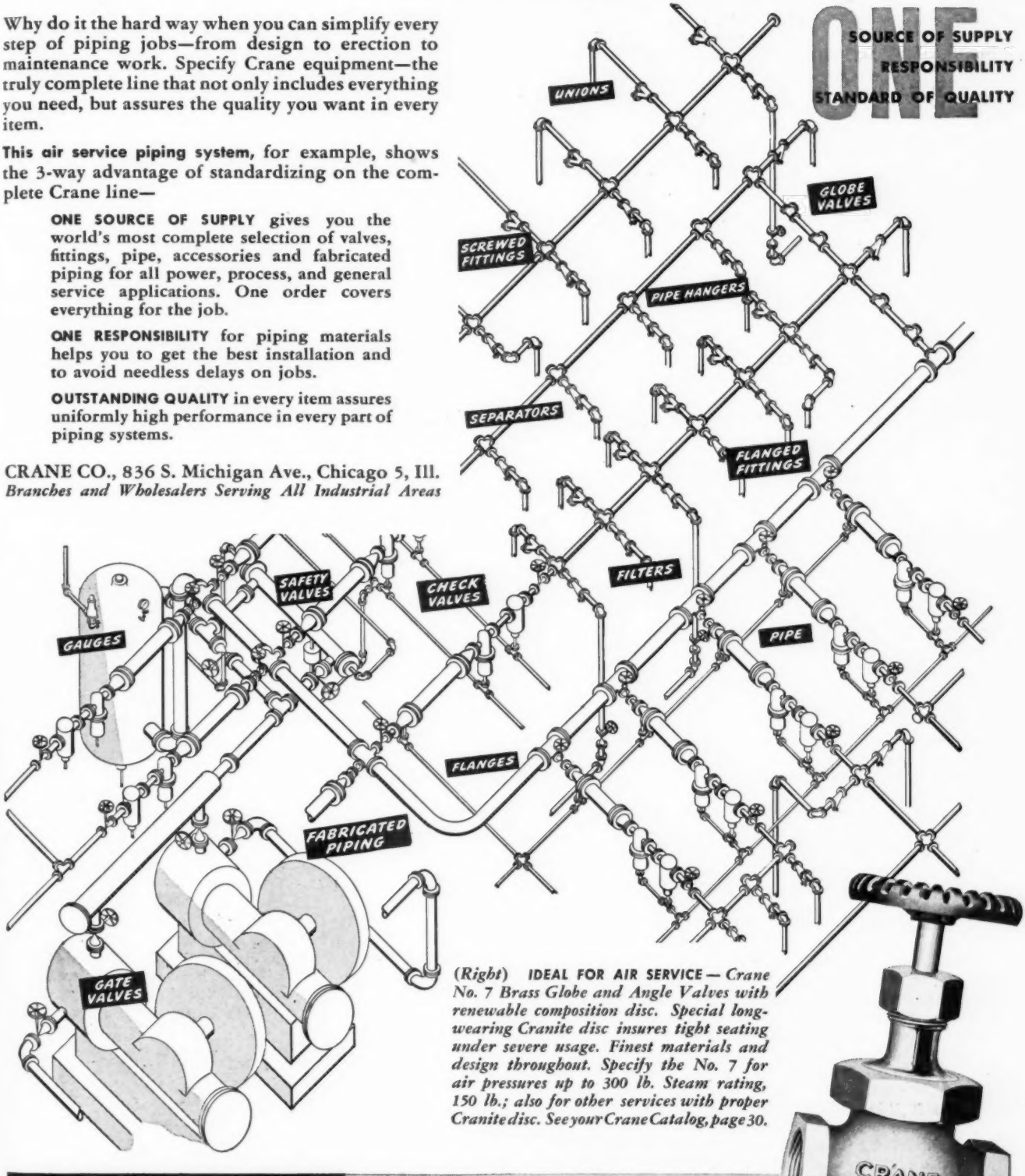


(Right) **IDEAL FOR AIR SERVICE**— *Crane No. 7 Brass Globe and Angle Valves with renewable composition disc. Special long-wearing Cranite disc insures tight seating under severe usage. Finest materials and design throughout. Specify the No. 7 for air pressures up to 300 lb. Steam rating, 150 lb.; also for other services with proper Cranite disc. See your Crane Catalog, page 30.*

EVERYTHING FROM . . .

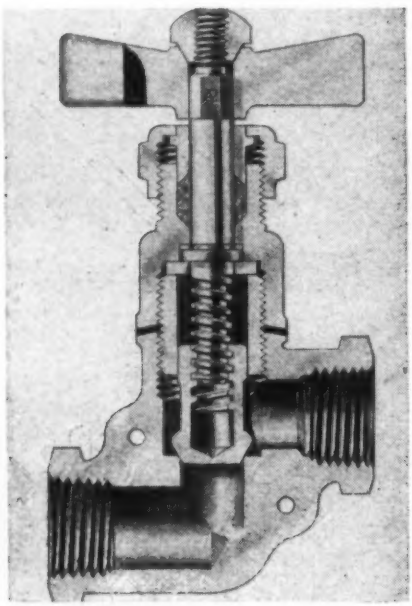
VALVES • FITTINGS
PIPE • PLUMBING
HEATING • PUMPS

CRANE

FOR EVERY PIPING SYSTEM

standard voltages and frequencies up to 125 v, relays are available with single- or double-pole, and single- or double-throw silver contacts. Single-break-contact ratings for standard relays are 4 amp, 125 v, ac, 60 cycles on noninductive loads.

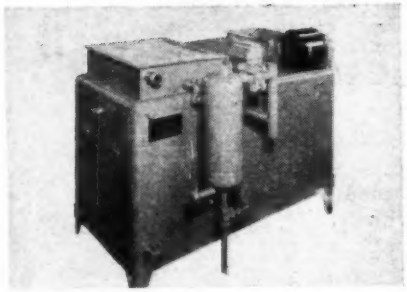
This *Bulletin* 106 relay is open type, mounted on a molded phenolic insulating base. Where inclosures are required, Bakelite covers, steel covers or watertight boxes are available for 2- or 3-wire instrument control. **Dept P, Ward-Leonard Electric Co, Mt. Vernon, N. Y.**



Industrial Valves

NEW SERIES OF INDUSTRIAL VALVES are available in needle and globe models in sizes up to 1 in., and in both angle and offset designs. Both needle and shutoff models are available in six variations of connection arrangements. Straight-line valves are available with female threads or with threads for flexible tubing. Angle models have female pipe threads, tube threads or male pipe threads at inlet connection and either tube or female pipe threads at side outlet. These arrangements permit connecting directly into either pipe or flexible-tube systems without using extra nipples, adapters, etc. They are available for tubing from ¼ to 1 in. outside diameter and pipe from ⅛ to 1 in.

Pressure drop through the valve has been cut 50% in offset design by eliminating pockets, angle ports and intricate chambers. Shutoff valves are of non-rising stem design and can be repacked under full-flow or no-flow conditions. **Dept P, Parker Appliance Co, 17325 Euclid Ave, Cleveland, Ohio.**



Evaporative Condenser

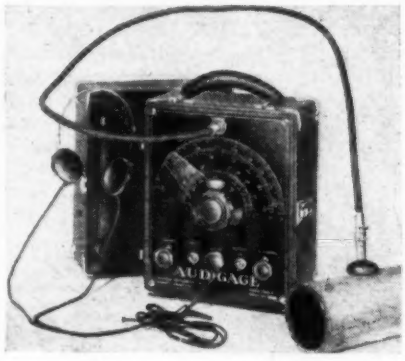
AEROPASS REFRIGERANT-GAS CONDENSER consists of dry and wet condensing coils. Former cools gas close to condensation and latter, using a water spray, completes process. A balanced wet-bulb control varies air steam across dry coil to obtain full condensing capacity and hold head pressure to a minimum.

An electric heater located in water reservoir is controlled by a thermostat to prevent freezing in cold weather. If outside temperature remains low, sprays and fans are automatically shut down, and feed line is drained. A rise in head pressure puts condenser back in operation. An oil separator is inserted between dry and wet coil. **Dept P, Niagara Blower Co, 405 Lexington Ave, New York, N. Y.**

Thickness Gage

AUDIGAGE is a portable self-contained instrument designed to measure wall thickness of pipes, tanks, pressure vessels, etc. Device can be used on steel, aluminum, brass, copper, glass and other materials from ¼ to 12 in. thick.

Gage uses a crystal-type head, powered by a frequency-modulated electronic oscillator. When vibrating crystal is applied to a surface the frequency at which the wall section resonates is directly proportional to velocity of sound in material and inversely proportional to thickness. Frequency difference between two signals is converted into thickness by instrument. **Dept P, Branson Instruments Inc, Joe's Hill Rd, Danbury, Conn.**



Multiple Oiler

THIS HEAVY-DUTY MULTIPLE OILER provides a removable strainer in each sight feed. Strainer and glass may be removed for cleaning without the use of tools or without stopping oil flow. This is done without removing piping or tubing on machine. All sight glasses and gage glass are protected from breakage. Tank has dust-tight reservoir cover, which is easily removed for filling operation. Union outlets on each feed are available in a variety of sizes. **Dept. P, Wm W Nugent & Co, Chicago, Ill.**

Multibreaker

MO-4 MULTIBREAKER IS ESPECIALLY ADAPTED for service entrance in houses. It can also be employed as a load-center distribution. *MO-4* is a 4-pole unit employing both thermal and high-speed magnetic tripping action on breakers. This dual protection operates so that bimetal elements function only when a sustained overload or heavy short circuit occurs and does not trip under harmless momentary overloads. Magnetic trip is used to clear circuits instantly under moderate or heavy short-circuit conditions.

Device is available in single-pole branch circuit capacities of 15, 20 and 30 amp. A tie between handles converts single-pole units into 2-pole switches if desired. **Dept P, Federal Electric Products Co, 50 Paris St, Newark 5, N. J.**

Hard-Facing Electrodes

NEW HIGH-CARBON ELECTRODES, designated *Hardweld* 50 *AC* and *Hardweld* 100 *AC*, are suitable for building up worn steel parts by welding with low-voltage ac transformers, as well as dc welders. *Hardweld* 100 *AC* has a deposit hardness on straight

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SEE REVERE

FOR CONDENSER TUBES AND PLATES

EXPERIENCE has proved that in a majority of installations Revere Admiralty Metal condenser tubes, inhibited to resist dezincification, will give long, satisfactory and economical service. However, Revere also makes tubes in Cupro-Nickel, Revalon (aluminum brass), Red Brass, Muntz Metal, Arsenical Copper, and Copper, thus enabling you to select the Revere Metal or Alloy best suited to meet your operating conditions.

In addition, Revere manufactures pipe and tube in copper and brass for general piping purposes, and electric welded steel tube.

Revere condenser plates can be had in a number of alloys in squares, rectangles, circles, half-circles, segments, and special patterns, up to 120 inches maximum dimension, finished weight about 11,000 lbs. maximum. These plates are flat, dense, free from blow holes or other imperfections, accurate in gauge, and are easily machinable.

As each condenser, heat exchanger or other piece of equipment using tubes and plates presents an individual combination of conditions, no blanket recommendations are possible. Among the factors to be considered are: chemical and impingement attack, velocities, pressures, temperatures, air entrainment, suspended solids. Should short tube life or other circumstances lead you to question your present practices, the Revere Technical Advisory Service will gladly cooperate with you in making thorough field and laboratory studies, to assist you to determine the most serviceable and economical alloys.

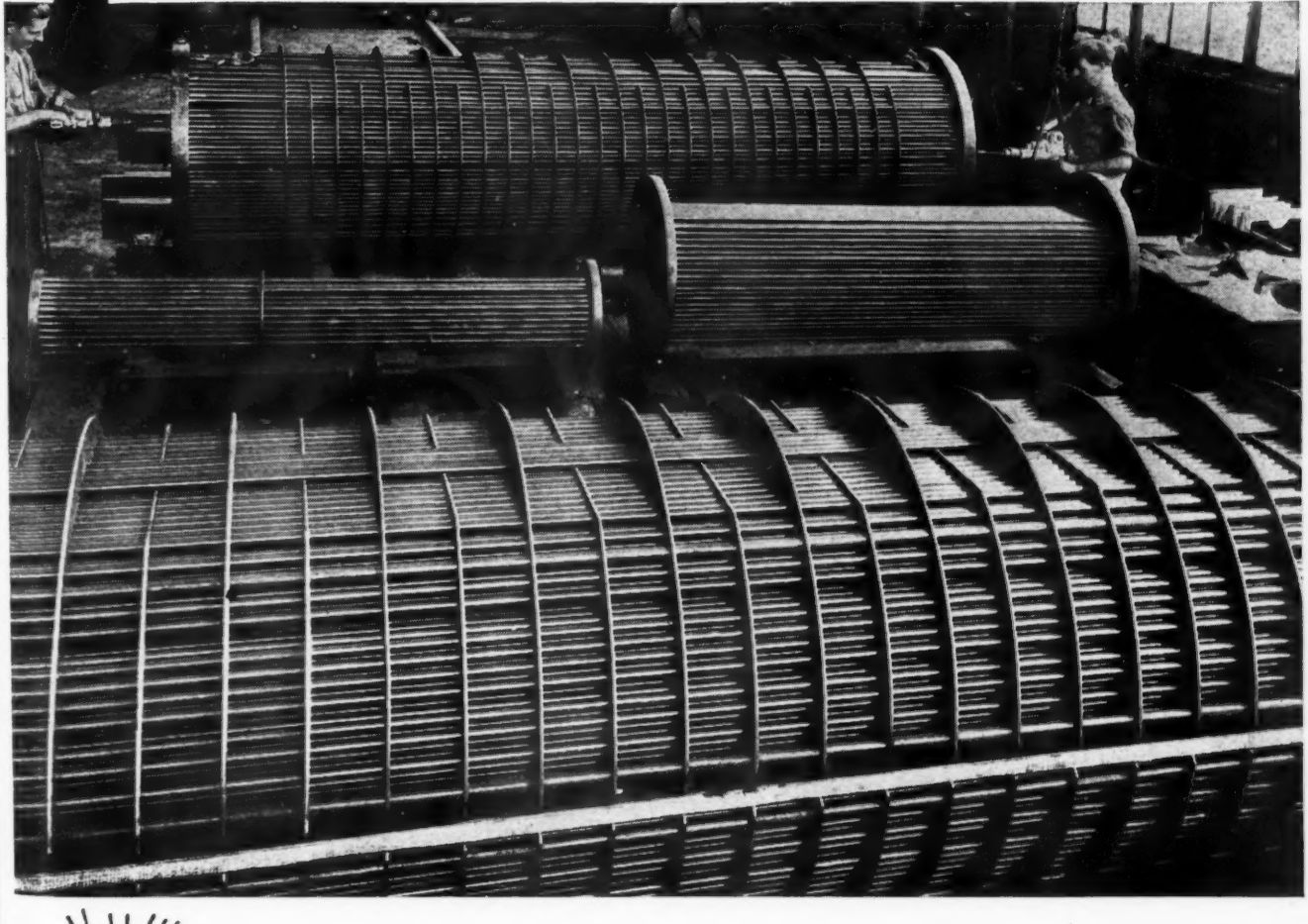
REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y. — Sales Offices in Principal Cities, Distributors Everywhere.



Listen to *Exploring the Unknown* on the Mutual Network every Sunday evening, 9 to 9:30 p. m., EST.

carbon steel of 20 to 45 Rockwell C when allowed to cool naturally. Exact hardness depends upon rate of cooling and carbon content of steel welded. On straight carbon steel *Hardweld* 50 *AC* has a hardness of 20 to 35 Rockwell C. *Hardweld* 100 *AC* comes in 1/8, 5/32, 3/16 and ¼-in. sizes. Hardweld 50 *AC* comes in 3/16 and ¼-in. sizes. **Dept P, Lincoln Electric Co, Cleveland 1, Ohio.**

Mercury Switch

AN ALL-METAL MERCURY SWITCH, TYPE D-100, is cool in operation at 100 amp continuous current. It also provides safe operation due to a fused hermetic seal between metal and ceramic. Switch is 4 in. long and 1¼ in. in diameter, and has a continuous rating of 100 amp at 110 or 220 v ac or dc. It is entirely metal inclosed, thus providing safe and hazard-free operation in atmospheres where condition of switch sparking is a danger. **Dept P, Mercontrol, Inc, 278 Pearl St, New York, N. Y.**

Pressure Switch

A NEW SERIES of pressure switches control automatic gas, oil or coal-fired steam boilers. This series is also available for air and refrigeration compressors and pumps. Each unit is a versatile switch, which is applicable to many operating maintenance problems or industrial processing jobs where accurate control is essential. Pressure range on *H*-701, first in the series, is from 1 to 10 psi, with a differential from 1 to 5 psi. The series also contains units available up to 300 psi and differentials from 1 to 80 psi, with micro-switch contact arrangements of normally off and normally on. The *H*-700 handles any liquid or gas not injurious to brass.

Control is easily set by a fingertip adjustment from outside of cover. Accurately calibrated scales for range and differentials are easily read through a window in cover. **Dept P, Aerotec Co, White Plains, N. Y.**

Ac Welder

NEW FLEET-ARC AC WELDER is equipped with *Arc Booster* that augments the current the instant arc is struck. A selector switch on front of welder governs amount of booster current to be used in striking arc. Welding-current regulation is provided by a rotating reactor control manipulated through a handwheel on case.

Fleet-Arc comes in 200-, 300- and 500-amp. sizes. Its lower open-circuit voltage requires less condenser capacity, which reduces idle input current considerably. **Dept P, Lincoln Electric Co, Cleveland.**

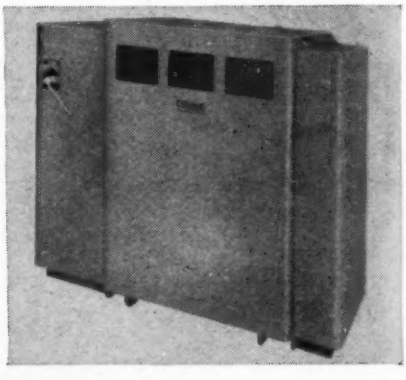
Solderless Connector

SCRU-IT is a hot, molded, Bakelite solderless connector, especially designed for quick and easy joining of standard-gage electrical wires. It is not affected by heat, cold or humidity, and is used for making permanent wire connections or for roughing-in work without tape, solder or flame. It is safe and fast. Wire ends are stripped and *Scru-It* screws right on. Compact size permits its use in switch boxes, fixtures, fuse boxes, etc. **Dept P, Solar Electric Corp, Warren, Ohio.**

Wire Connectors

THIS 4-IN-1 SIZE of solderless and tapeless wire connector eliminates need for four different sizes. Unit is approved by Underwriters Laboratories, states the manufacturer, for joining 46 different wire combinations, ranging from two No. 18 wires to four No. 14 wires, with one No. 18, or two No. 12's with one No. 16 solid or standard wires. Simplification of one connector for all common wiring joints avoids confusion, increases efficiency, and keeps down inventory on parts of electrical contractors, plant electricians and electrical manufacturers who make joints in production.

This unit is designed for making fixture joints, roughing-in joints, sign wiring and joints in electrical equipment and machinery. It is easy to use; just skin wires and screw it on. It is a one-piece device made of Bakelite and has a coiled-spring insert, which assures perfect electrical and mechanical joints. **Dept P, Holub Industries, Inc, Sycamore, Ill.**



Unit Substation

HIGH-VOLTAGE INCOMING LINE, transformer, and low-voltage feeder section are all combined in one compact assembly in the all-in-one unit substation. Of streamlined construction, unit can be supplied with air-cooled transformers. *Noflamol*, or oil-filled transformers as desired. Substations are standardized in ratings of 100, 150, 200 and 300 kva, 3-phase, 60-cycle. Choice of combinations of different transformers and high- and low-voltage equipment makes them suitable for a wide range of applications. **Dept P, Wagner Electric Corp, St. Louis, Mo.**

Thermo Silicone Resin

DC 2103 IS A THERMOSETTING SILICONE RESIN especially designed as a heat-stable bonding material for inorganic fabrics. This material is used in production of rigid electrical laminates and for bonding highly divided particles, such as powdered metals,

(*Continued on page* 202)

POWER brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P

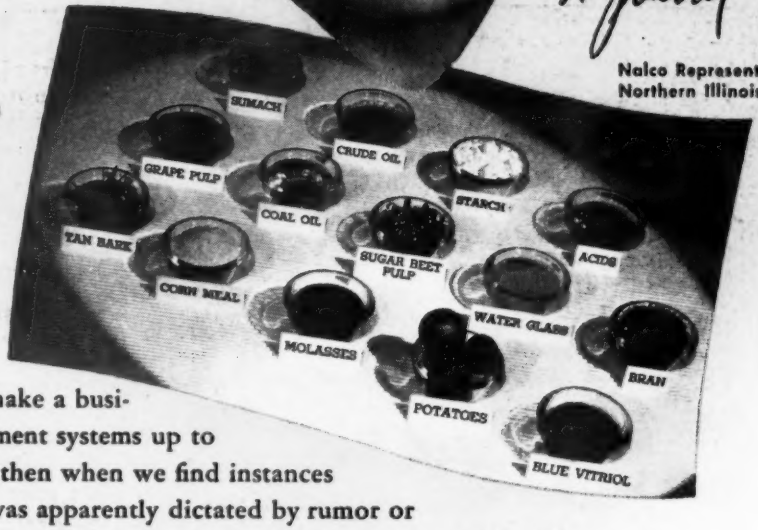
Hard to believe...

. . . but some water treatments are still based on Rumor and Folklore

says:

L Plubal

Nalco Representative
Northern Illinois



Some of the Folklore Water Treatments

Only a few of the strange materials Nalco engineers have found being used as boiler water treatments are shown here. Some are partially effective . . . Others are actually dangerous.

EVEN those of us who make a business of bringing water treatment systems up to date get a surprise now and then when we find instances where the water treatment was apparently dictated by rumor or folklore, or both. Putting the Nalco System to work in such a plant is usually spectacular . . . Simply because of the vast improvement in boiler and general plant performance. And this difference, in varying degrees, is usually apparent when the Nalco System begins to operate in any plant.

A Nalco survey and recommendations (if necessary) for complete, scientific water treatment in your plant will cost you nothing—may be the means of substantial savings in overall plant operating costs. Write today for complete information.

NATIONAL ALUMINATE CORPORATION

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nalco

The Scientific Water Treatment for All Industry

How to plan

BOILER FEED PUMP CONNECTIONS

Another in the series of basic Piping Layouts prepared by Jenkins Bros.

● **Typical Equipment** for boiler feed pumping connections in high pressure systems operating at less than 500 p.s.i. are shown in this layout.

Two Pumps are normally required to handle the full capacity of the boilers, with one serving as a standby. Either pump may be connected to any one header with a tie between two headers.

The Discharge from the feedwater heating equipment goes into a boiler feed suction loop which allows for segregation of feed to individual pumps and provides the insurance against failure of two independent feedwater lines.

Pressure Relief Valves on the pump discharges regulate discharge pressure at a constant value, despite fluctuations imposed on the system by the boiler feed regulators, without regulating pump speed.

Drains are provided at the heels of the suction lines to the pumps and between the check and globe valves on the pump discharges.

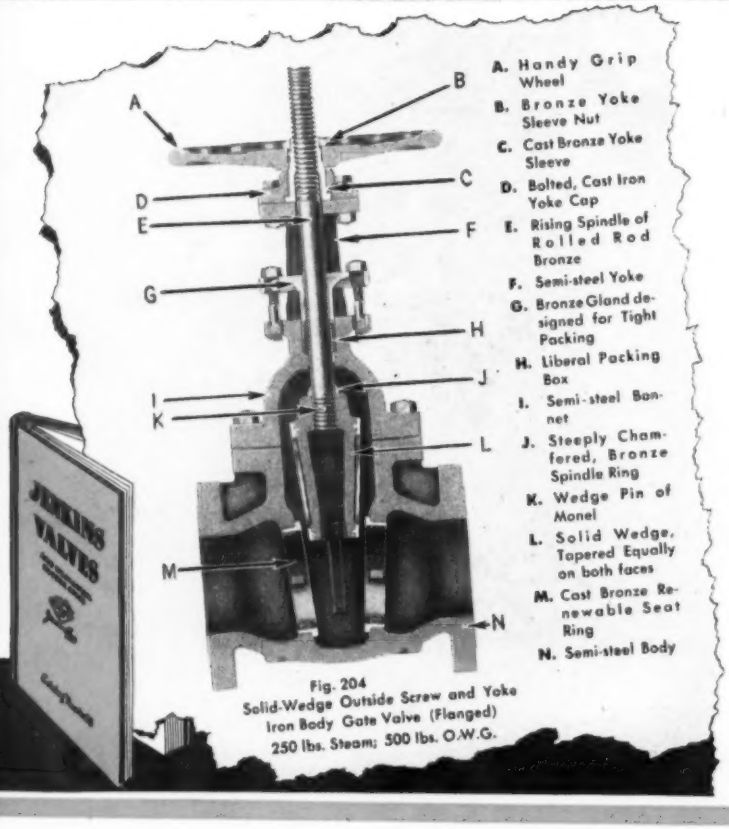
Globe and Check Valves with renewable bronze seat rings are recommended to permit easy and economical repairs should water conditions lead to rapid corrosion. Large valves are of the Outside Screw & Yoke design to permit lubrication of spindle threads, minimize corrosive action on spindle threads, and provide a ready indicator of the wedge position. Swing check valves are used on the pump discharge line for smooth operation. Globe valves control the pump discharge to permit throttling without overloading the motors if the pumps are oversized.

Jenkins PRACTICAL PIPING LAYOUTS

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A Use the right type valve for the service.
B Place valves correctly in the line.
C Choose Jenkins Valves for lifetime economy.

19



A. Handy Grip Wheel
B. Bronze Yoke Sleeve Nut
C. Cast Bronze Yoke Sleeve
D. Bolted, Cast Iron Yoke Cap
E. Rising Spindle of Rolled Rod Bronze
F. Semi-steel Yoke
G. Bronze Gland designed for Tight Packing
H. Liberal Packing Box
I. Semi-steel Bonnet
J. Steeply Chamfered, Bronze Spindle Ring
K. Wedge Pin of Monel
L. Solid Wedge, Tapered Equally on both faces
M. Cast Bronze Renewable Seat Ring
N. Semi-steel Body

Fig. 204
Solid-Wedge Outside Screw and Yoke Iron Body Gate Valve (Flanged)
250 lbs. Steam; 500 lbs. O.W.G.

Other types and pressure ranges of Jenkins Valves can be used for this type of layout according to the factors involved. Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

Copies of Layout No. 19 will be furnished on request . . . also future Piping Layouts. Mail coupon.

Fig. 204, an Iron Body Gate Valve, is exceptionally dependable for steam, oil, water and gas service where full, free, unobstructed flow is desired. For steam lines especially, the solid wedge provides maximum resistance to pressure strains, assuring longer life in rapidly vibrating steam currents. Clean out pockets can be furnished on application. Fig. 204 is recommended in this layout because of its exceptional wear-resisting qualities.

A CHOICE OF OVER 600 JENKINS VALVES

To save time, to simplify planning, to get the advantage of Jenkins specialized valve engineering experience . . . select all the valves you need from the Jenkins Catalog. It's your best assurance *of the lowest cost in the long run.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport; Atlanta; Boston; Philadelphia; San Francisco; Chicago; Jenkins Bros., Ltd., Montreal; London, England.

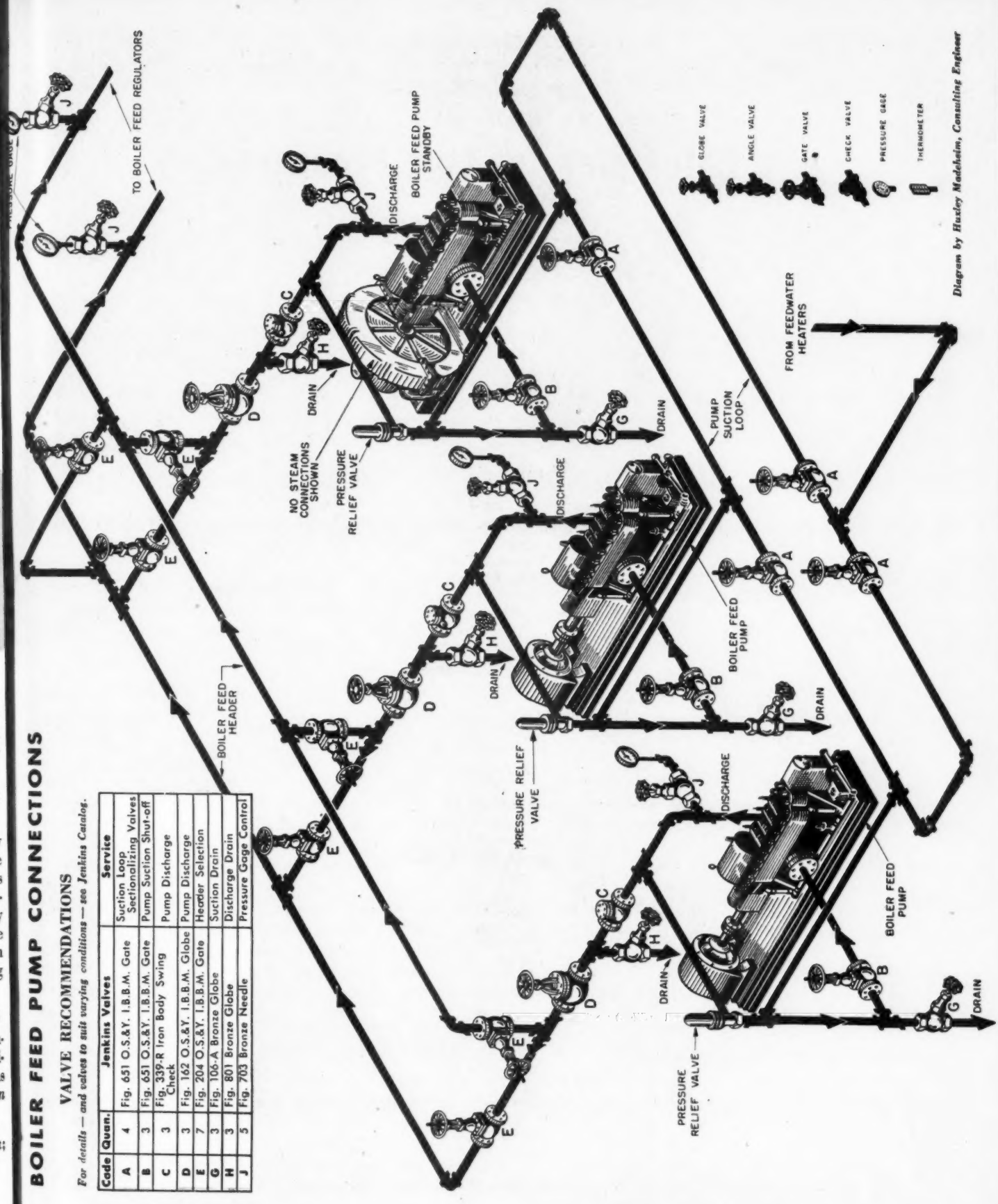
JENKINS VALVES

LOOK FOR THE DIAMOND MARK
SINCE 1864

TRADE JENKINS MARK

125 TO 600 LBS. STEAM PRESSURE

BOILER FEED PUMP CONNECTIONS



BOILER FEED PUMP CONNECTIONS

VALVE RECOMMENDATIONS

For details — and valves to suit varying conditions — see Jenkins Catalog.

Code	Quan.	Jenkins Valves	Service
A	4	Fig. 651 O.S.&Y. I.B.B.M. Gate	Suction Loop Sectionalizing Valves
B	3	Fig. 651 O.S.&Y. I.B.B.M. Gate	Pump Suction Shut-off
C	3	Fig. 339-R Iron Body Swing Check	Pump Discharge
D	3	Fig. 162 O.S.&Y. I.B.B.M. Globe	Pump Discharge
E	7	Fig. 204 O.S.&Y. I.B.B.M. Gate	Header Selection
G	3	Fig. 106-A Bronze Globe	Suction Drain
H	3	Fig. 801 Bronze Globe	Discharge Drain
J	5	Fig. 703 Bronze Needle	Pressure Gage Control

BRONZE ★ IRON ★ STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE

SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

JENKINS BROS., 80 White St., New York 13, N. Y.

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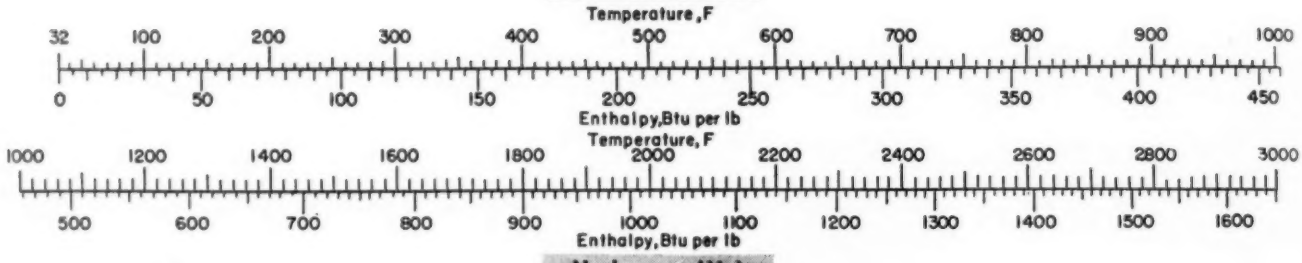
POWER'S DATA SHEETS

Number 174

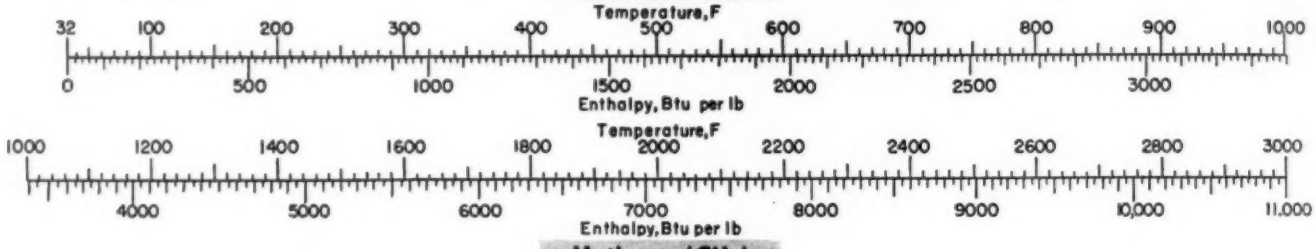
Gas Enthalpies (at Low Pressures): 1

By W M ROHSENOW and D A MOONEY
Massachusetts Institute of Technology

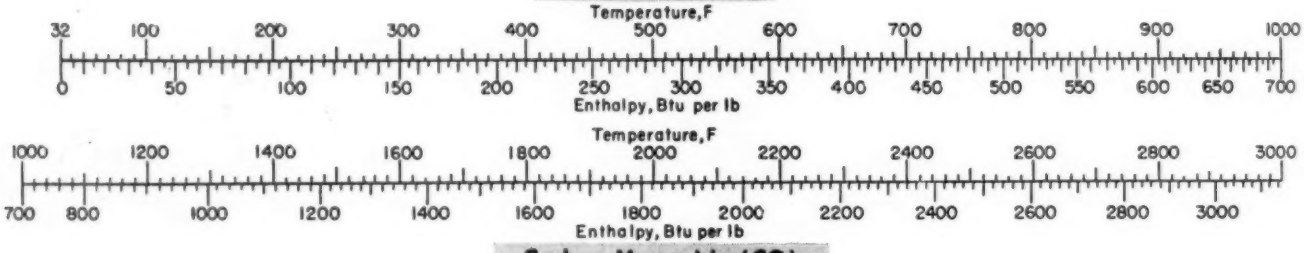
Steam (H_2O)



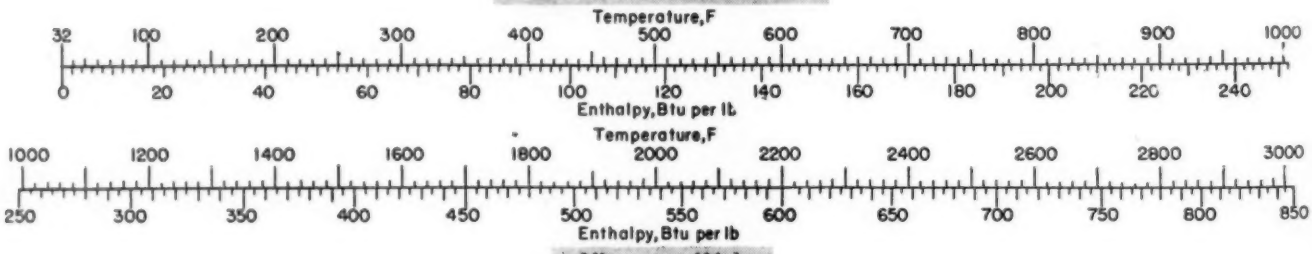
Hydrogen (H_2)



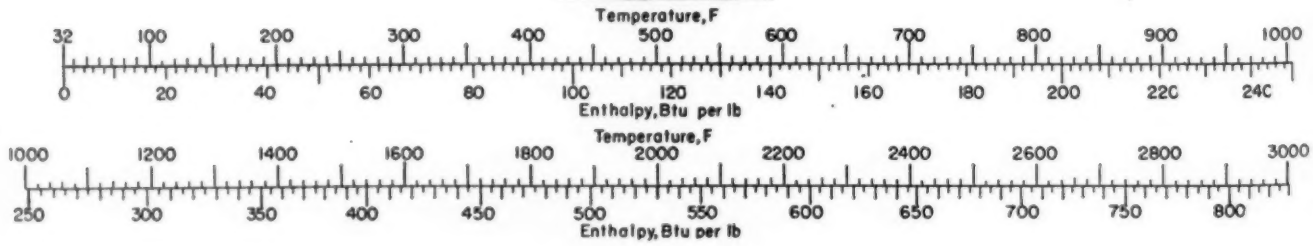
Methane (CH_4)



Carbon Monoxide (CO)



Nitrogen (N_2)



Data Sources: H_2O – Keenan & Keyes, below 1600 F; Sweigert & Beardsley, above 1600 F.
H_2, CH_4, CO, N_2 – Ellenwood, Kulik & Gay, Cornell Univ Engrg Experiment Station, Bulletin 30, Oct 1942.

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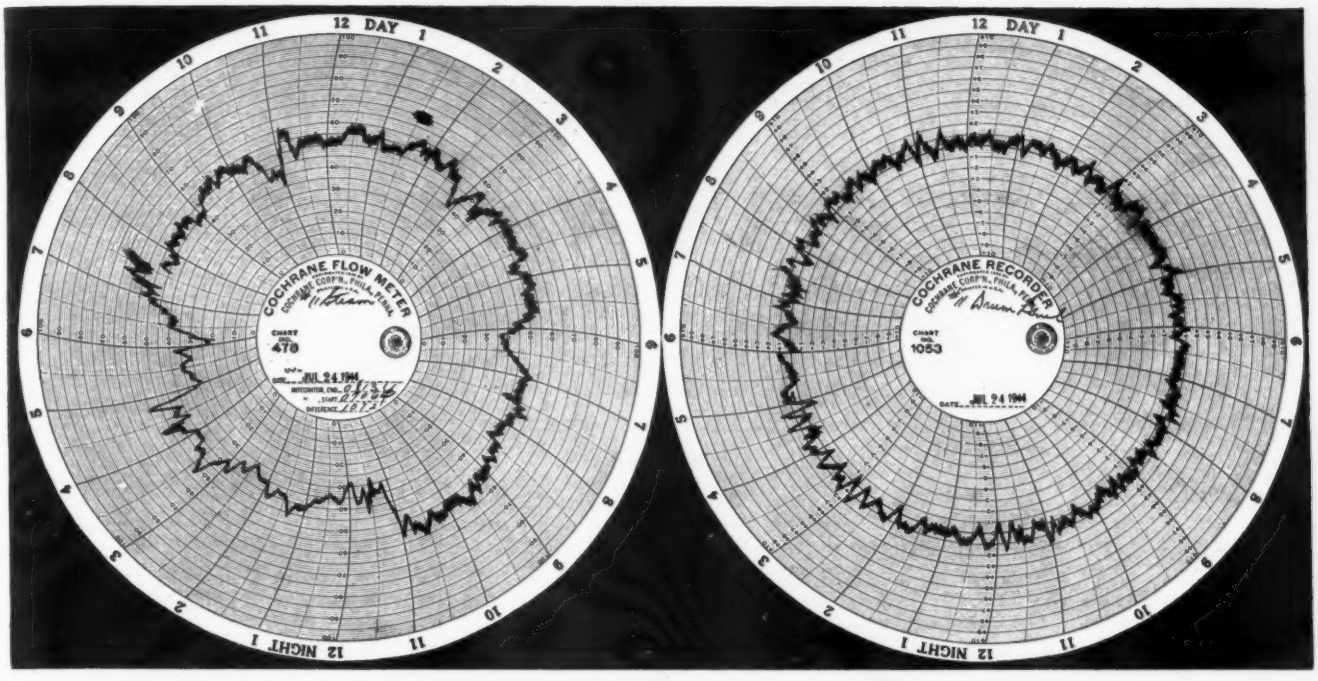


FORGING HAMMERS *Swing Steam* DEMAND 5,000 POUNDS PER HOUR INSTANTANEOUSLY

BOILERS carrying forging loads offer one of the more difficult problems of water level control. Their constant load fluctuations, caused by varying steam demands from hammers and presses, result in abnormal "shrink" and "swell" of fluid within the boiler drum. But COPES Flowmatic Control assures safe, dependable stabilization of the boiler water level, no matter how rapid or wide the load swings.

At Ingalls-Shepard Division of Wyman-Gordon Company, Harvey, Illinois, COPES Flowmatic stabilizes water level within plus-or-minus 1½ inches, despite almost instantaneous load swings of 5,000 pounds per hour. That's why all eleven boilers are equipped with COPES Flowmatic. Write for Bulletin 459—Water Level Control on Drop Forge Loads at Wyman-Gordon Company—a performance report.

NORTHERN EQUIPMENT COMPANY

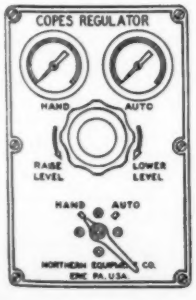
271 GROVE DRIVE, ERIE, PENNSYLVANIA

Feed Water Regulators, Pump Governors, Differential Valves, Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS: Canada, England, France • *Representatives Everywhere*

★ GET CLOSER LEVEL CONTROL WITH COPES FLOWMATIC

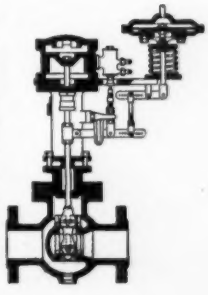
AIR-OPERATED REMOTE CONTROL



Permits absolute flexibility of installation for COPES Feed Water Regulators of either simple-level-control or two-element Flowmatic type. COPES transfer switch and control panel illustrated provides remote positioning of feed valve from boiler operating board or any other desired point. Air is used as the operating medium. Dependable performance is demonstrated daily in many COPES-equipped high-duty steam-generating stations.

PRESSURE REDUCING VALVES

Ideal for those applications where results not attainable with "stock" valves are desired. There are eight types, direct-and relay-operated, from which COPES engineers select the one best suited to demands of the individual installation, then design ports and pressure range for the specified conditions. Low friction, accurate balance and ample power. Available as single units or for multiple installations. COPES Master Control permits remote operation.



FACT OR FICTION?

"It ain't what we believe that's important; it's what we believe *that ain't so!*" This remark of Abe Martin's is old, but not nearly so old as some of our most-cherished ideas—ideas that date back to the cave man.

As Bergen Evans puts it in his *Natural History of Nonsense:* "We may be through with the past, but the past is not through with us. Ideas of the Stone Age exist side by side with the latest scientific thought. Only a fraction of mankind has emerged from the Dark Ages . . . Seemingly sane men entrust their wealth to stargazers and their health to witch doctors. Giant planes throb through the stratosphere, but half their passengers are wearing magic amulets and are protected from harm by voodoo incantations. Hotels boast of express elevators and a telephone in every room, but omit thirteen from all floor and room numbers lest their guests be ill at ease . . ."

Have you checked your ideas lately?

Do you worry about black cats, Friday the thirteenth, thirteen at table? Do you whistle your way past a cemetery? How about umbrellas opened indoors, three on a match, "lucky" coins? Do you carry a rabbit's foot? Have you the first dollar you ever earned?

Are you convinced that smart men vote as you do, live as you do, worship as you do, read the same newspapers and books, enjoy the same sports, games and entertainments? Are there two sides to every question: yours and the wrong side? Is the Boss always wrong?

Are you married to equipment that should have gone in the first scrap drive? Do you still burn incense over your feedwater? Is the primary requirement for a fireman a pair of bulging biceps? Are the oil can and monkey wrench still your most-used tools? Do you believe that a good plume of smoke shows your plant is operating? Do you believe that every man in your crew should accept your word and your opinion as final authority on anything having to do with the plant?

Yes, check over your ideas and beliefs. You will find an amazing number that are just habit or superstition, accepted through the years because nothing has ever forced you to question them specifically. All of our background tends to make us resist change, much as we prate of progress. We are brought up to believe in tradition, to accept the dictates of older people and more important people, to swear by the printed word no matter who printed it.

No one can distinguish fact from fiction for you—that you must do for yourself or you'll end up with your mind cluttered with superstitions.

George Edwards
Engineer

For Insulation Jobs, too

IT HAS TO BE RIGHT THE FIRST TIME

...and a first choice of industry for the right insulating job is the Johns-Manville Insulation Applicator

Even the finest insulation must be properly applied to provide top fuel savings and operating efficiency.

The Right Insulation for Every Application

Your J-M Insulation Applicator selects the right materials for your job from the wide variety in the J-M industrial insulation line (for temperatures from 400 F below zero to 2800 F above).

Johns-Manville Insulation specialists, plus the facilities of the J-M Research Laboratory, are available to help you with your particular insulation problems, no matter how complex they may be.

Expert Application of the Right Insulation

J-M Insulation Applicators are a first choice of industry for completely efficient jobs because: (1) They are trained in all phases of insulation application. (2) They employ skilled mechanics and the most up-to-date methods of application.

For further details, write your nearest J-M Insulation Applicator or Johns-Manville, Box 290, New York 16, New York.

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POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

When Will Atomic Energy Be An Industrial Power Source?

Here are conditions under which atomic piles can be operating within five years to produce electric power, as outlined by the new five-man Atomic Energy Committee of the New England Council

► PRODUCTION OF ATOMIC ENERGY for industrial power purposes is not only technically and economically feasible but, under certain conditions, "atomic piles could be operating within five years for the purpose of producing electric power," the Atomic Energy Committee of the New England Council announced recently.

The Council's 5-man Atomic Energy Committee is composed of William Webster, vice-president of New England Power Assn, Boston, chairman; Karl T Compton, president of Massachusetts Institute of Technology; Bradley Dewey, president of Dewey and Almy Chemical Co, Cambridge, and president of the American Chemical Society; Frederick S Blackall, jr, president of The Taft-Peirce Mfg Co, Woonsocket, R. I., and Chester M Alter, dean of Boston University Graduate School, and Committee secretary.

Created with the immediate objective of gathering information regarding the potential utilization of atomic energy as a source of power, the Committee points out in its report that "In a region such as New England, where we have a relatively high concentration of industry dependent on power, any new source of power is naturally of great importance to those interested in the future economy of the region.

"Although, as yet, no atomic-power plants have been built, there now seems to be no question, from the purely technical standpoint, about the possibility of generating large amounts of power from the heat liberated during the operation of atomic piles," the Committee's statement continues.

"The research and development necessary to bring about the practical utilization of atomic energy for industrial power to propel ships, to turn the wheels of factories, to light our homes, will cost money, a lot of money.

"This Committee strongly recommends that federal funds, proportionate to the over-all significance of this new power, be made available for research in and development of peacetime industrial and humanitarian application of atomic energy as well as for large-scale fundamental studies of nuclear phenomena. This is one kind of governmental financing that we cannot afford to curtail whatever may be the national policy along general lines of retrenchment and economy.

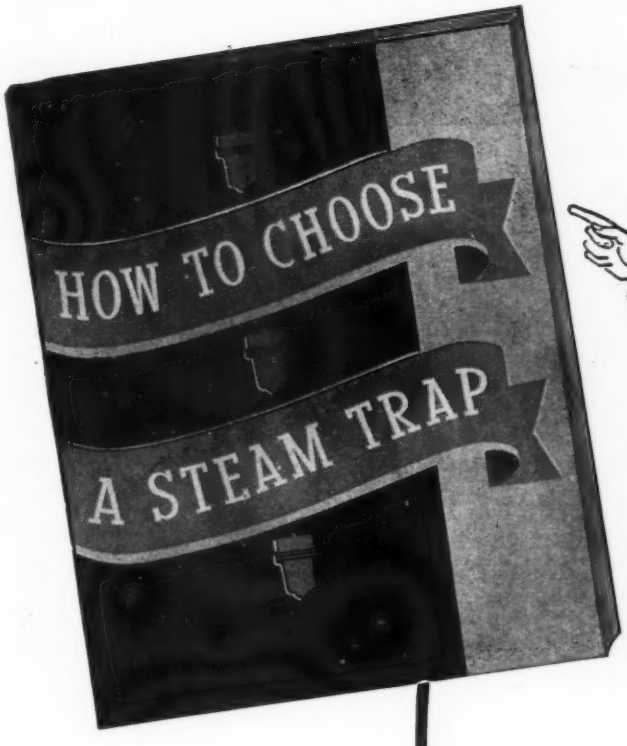
William Webster, vice-president of New England Power Assn, Boston, is chairman of Atomic Energy Committee

"Although the information regarding the cost of producing electric power from atomic piles is meager, that which has been released by the U. S. representative on the United Nations Atomic Energy Commission leads this Committee to believe that electric power can be produced from such units at a cost comparable with that from the most modern high-pressure tidewater steam central stations. It is also believed that with further research and development the eventual cost of producing power from the atom may go well below present production costs.

"It should be pointed out, however, that the cost of power to the consumer, be he an industrial or a household user, includes much more than the cost of production. For residential electric power probably less than a quarter of the cost to the consumer is due to cost of production. Transmission to the substations and distribution and service to the consumer account for much more of the cost than does production alone. Therefore, generally speaking, the substitution of an atomic-power plant for a high-pressure steam plant might not substantially reduce the cost of current to small users.

"It is difficult to predict what the first commercial uses of atomic power will be. It seems likely that it will be for purposes needing heavy and continuous loads of power. Today the location of many industries is closely related to the source of power—water or fuel. An atomic-power plant will be essentially a saver of fuel even though it may be at a relatively high capital outlay. Atomic fuel is so concentrated in form that the problem of its transportation is of negligible importance. New England is at a greater distance from coal mines than any other part of the industrial East and, therefore, has much reason to be interested in a source of power which does not involve a consideration of freight costs or possible transportation tie-ups. This new source of power should be particularly attractive to certain types of industry (those needing great quantities of heat, for example) which may

(*Continued on page* 158)



5 steps to correct

STEAM TRAPPING

1. **Find the condensation rate.**
2. **Make right allowance for air handling needs.**
3. **Consider peak load conditions and pressure fluctuations.**
4. **Look at the low cost factors of installation and maintenance.**
5. **Pick the type, size and make of trap to fit your needs.**

● This book is a time-saver. It helps you through each of the five steps necessary in getting the right steam trap for your needs. For the more common pieces of equipment, this book gives the size of trap that gives utmost satisfaction. For other equipment, a simple calculation with tables gives a quick answer.

Air handling considerations are clearly stated, as are allowances for peak loads. Besides these details there are cautions and recommendations, standard practice hints; notes and drawings on installations; maintenance suggestions and many other helps and tips for ready reference—things you don't want to remember but occasionally need to know. Do you want this kind of help? Then send for your free copy today.

THE V. D. ANDERSON COMPANY
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SUPER-SILVERTOP STEAM TRAPS

Atomic-Energy Commission Takes Domestic Control

▶ DOMESTIC CONTROL and development of America's first nationalized industry, atomic energy, was transferred from military to civilian direction formally at the beginning of 1947. Keynote was a pledge to proceed "affirmatively and aggressively with development of peacetime applications" of the force which to date has proved to be only the world's most potent means for destruction.

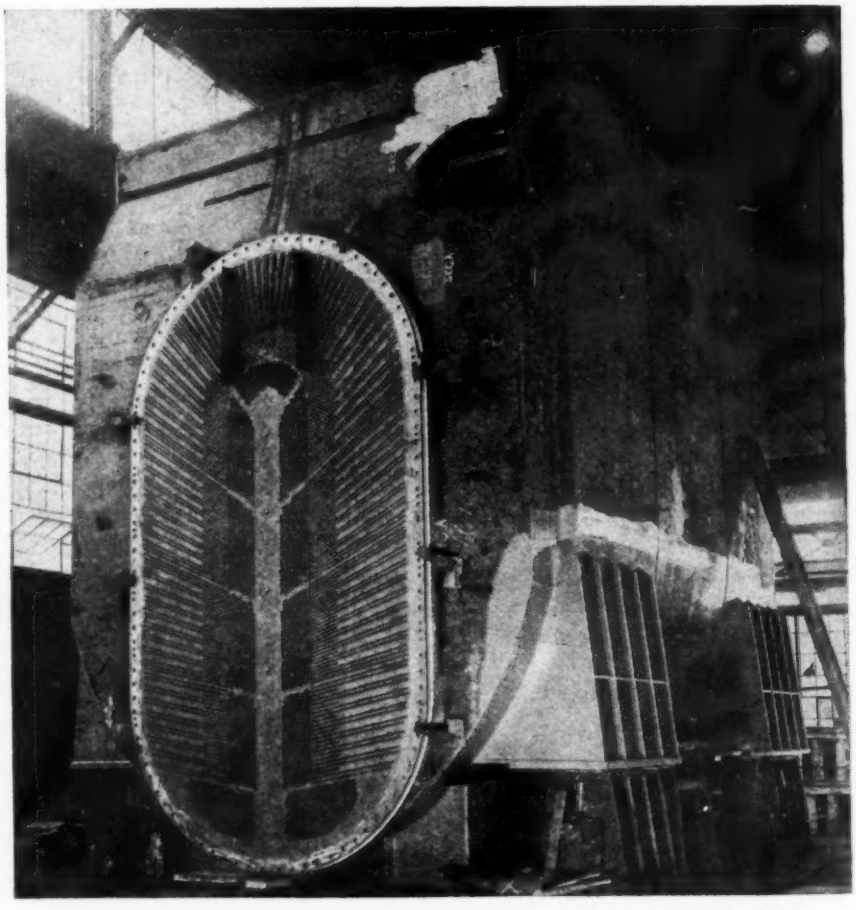
The pledge to push peacetime development of atomic power came from Carroll L Wilson, the newly appointed general manager of the 5-member Atomic Energy Commission. The 36-year-old manager was named to the key AEC post by President Truman on the eve of transfer to the agency by Presidential executive order of Government facilities, which cost more than $1,500,000,000 to build and of nearly 50,000 research and production personnel from Army's Manhattan District, wartime producer of the atom bomb.

Wilson was the unanimous choice of AEC members and of the President's Atomic Advisory Committee of top-flight nuclear physicists for the general managership, a post rated equal in importance to commission membership. As general manager, Wilson virtually becomes a "vice-president in charge of operations" of the commission's activities; his $15,000 salary is the same as that for commission membership and his appointment, like theirs, is subject to Senate confirmation.

During the war Wilson was executive assistant to Dr Vannevar Bush, in the Office of Scientific Research and Development, and last year was secretary of Lilienthal-State Dept Board, which developed basic principles of the U. S. plan for international atomic control, patterned in large measure upon domestic authority vested by Congress in the Atomic Commission.

A graduate, in 1932, from Massachusetts Institute of Technology with a S. B. degree in engineering and business administration, he served before the war as assistant to Dr Karl T Compton, president of MIT, and later as assistant to Dr Bush, then MIT engineering dean, in development of a general program for administration of patents on inventions by Institute staff members. He joined Dr Bush in June 1940 as one of two original members

(*Continued on page* 160)



HUGE CONDENSERS INSTALLED IN UTILITY

Two condensers, built at Foster Wheeler Corp's plant in Carteret, N. J., are being installed in Southwark Station of Philadelphia Electric Co in Philadelphia. They are the two largest cross-flow condensers ever built—each unit is larger than a complete 5-room house. Measuring 35x46½x20 ft, each condenses exhaust steam from a turbine-generator of 150,000-kw capacity. Water is circulated at 146,000 gal per min through the condenser tubes. At higher loads, 1,300,000 lb of steam per hour are condensed in each of these units

COMING EVENTS

Feb 24-28—American Society for Testing Materials, spring meeting, Benjamin Franklin Hotel, Philadelphia.

Mar 17-19 — Chicago Production Show, Stevens Hotel, Chicago, Ill. Chicago Technical Societies Council, 55 W Jackson Blvd, Chicago 4, Ill. Dates correspond with 3-day conference of 48 affiliated technical societies.

Mar 22-27—Fifth Western Metal Congress & Exposition, Civic Auditoriums, Oakland, Calif. W H Eisenman, managing director, American Society for Metals, 7301 Euclid Avenue, Cleveland 3, Ohio.

Mar 25-28 — Seventeenth Annual Safety Convention & Exposition, Hotel Pennsylvania, New York, N. Y. William F Brown, general chairman, Greater New York Safety Council, 60 E 42nd St, New York 17, N. Y.

Mar 31-Apr 2—Midwest Power Conference, Palmer House, Chicago, Ill. Stanton E Winston, director, Illinois Institute of Technology, 41 W 33rd St, Chicago, Ill.

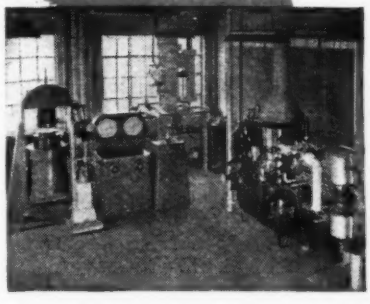
Apr 7-10 — Corrosion Engineers' Convention, Palmer House, Chicago, Ill. A B Campbell, executive secretary, National Asociation of Corrosion Engineers, 905 Southern Standard Bldg, Houston 2, Tex.

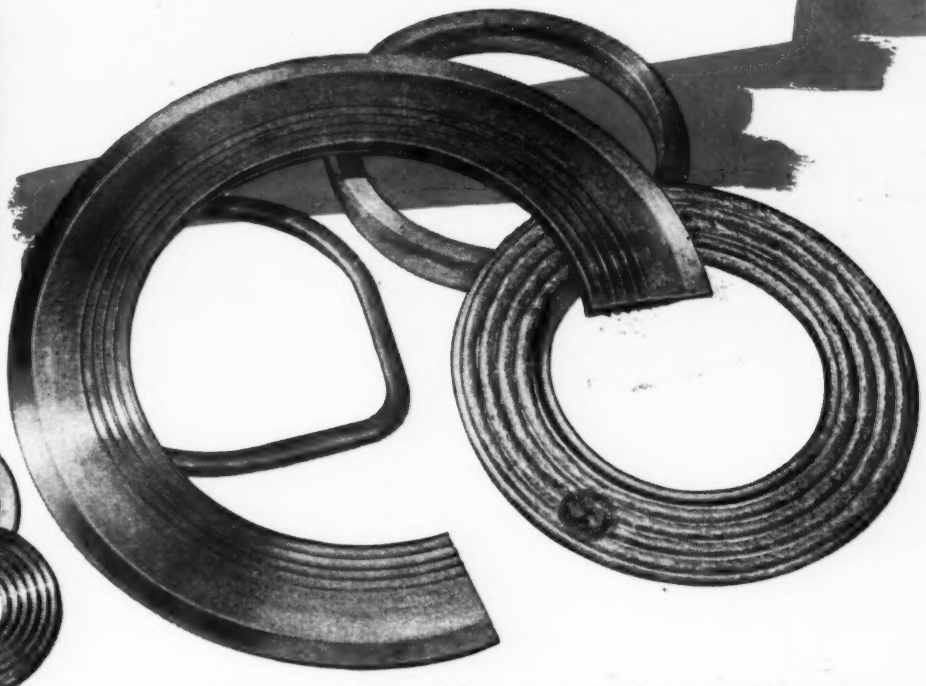
Apr 11-12—New Jersey Society of Professional Engineers, Essex House, Newark, N. J. Charles J Dodge, managing director, 86 E State St, Trenton, N. J.

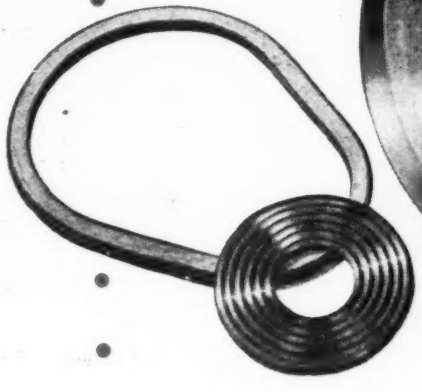
Apr 14-17—Southern Machinery & Metals Exposition, Municipal Auditorium, Atlanta, Ga. Michael F Wiedl Jr, managing director, P O Box 4687, Atlanta 2, Ga.

100% Joint Efficiency

—the result of RESEARCH







The single objective of Goetze laboratory research is to provide gaskets that give 100 per cent joint efficiency not only under ordinary conditions, but also unusual conditions of temperature, pressure, corrosion or any other factor.

The results of this research have been the development of the only *complete* line of metal gaskets — a line that makes it possible for Goetze to supply the right gasket for your particular applications.

And this research has proved something else: Most gasket troubles aren't necessary. Let a Goetze representative help you review your gasket usage. The chances are that the troubles you take for granted can be eliminated.

We invite your inquiries. What are your problems?

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Ask to have your name added to the list of engineers receiving "The Gasket"—a series of technical bulletins containing original and useful gasket information from the Goetze Research Laboratory. Write on your company letterhead giving your position.

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Goetze for GASKETS

"America's Oldest and Largest Industrial Gasket Manufacturer"

The picture above shows a Zallea Duo-equalizing Expansion Joint installed on the main steam line of a large chemical plant which has a production capacity of $100,000 per day.

If this joint should fail, production would cease and costly delays result. But the word *"if"* just isn't associated with the job this Zallea Expansion Joint has to do. Installed 13 years ago, it is *still* performing its intended job *today*—absorbing movement due to contraction and expansion of the steam line.

It's the quality Zallea builds into *every* expansion joint that makes them last . . . even in the severest service. Remember, there's *no* packing to deteriorate . . . *no* maintenance required.

Zallea Corrugated Expansion Joints are made in non-equalizing, self-equalizing and duo-equalizing types, depending upon the conditions under which they must operate . . . of copper, stainless steels and other corrosion-resistant alloys . . . diameters from 3" upward . . . traverses up to 7½" . . . for pressures from vacuum to 300 psi . . . for temperatures from sub-zero to 1600° F. Let us quote on your requirements.

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Specify and Demand ZALLEA Furnace-Annealed **Expansion Joints**

PUMPS Q & A

(*Continued from page* 116)

Q 12—What types of power pumps require the greatest net positive suction head?

A—Speed and pressure influence suction head required. High-pressure pumps necessarily use heavy valves, and valve and passage areas cannot be made overly large without greatly increasing pump weight and cost. Thus high-pressure hydraulic pumps usually require considerable suction head, which is provided by bringing all returns to an elevated suction tank. High-speed pumps also require more suction head unless made with unusually large suction-valve area. High-speed hydraulic or boiler feed pumps may require as much as 15 to 20 psi net positive suction head.

Q 13—What piston speed is permissible for power pumps?

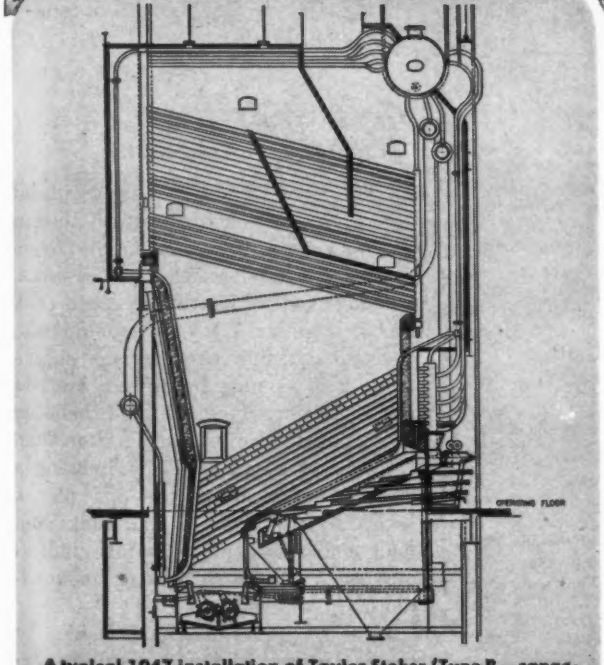
A—Modern 24-in.-stroke horizontal pumps are run at piston speeds of 300 to 400 ft per min. High-speed vertical pumps of 6-to-10-in. stroke are run at 200 to 250 ft per min. Smaller vertical pumps vary between 100 and 200 ft per min. Permissible piston speed for power pumps is usually two to four times that for direct-acting steam pumps.

Q 14—Should every power pump have a discharge relief valve?

A—Yes. This cannot be overemphasized. Directly connected to the discharge manifold of every pump should be a relief valve capable of discharging its full capacity at a reasonable pressure increase. For most installations set the relief valve for a pressure not more than 10% above maximum operating value. If a power pump is accidentally started against a closed discharge valve, the average electric motor develops sufficient starting torque to build up a pressure three or more times normal operating pressure. If the discharge valve is closed with pump running, inertia of rotating parts will add to the quick build-up of sufficient pressure to cause serious damage.

Q 15—Is a relief valve advisable on the suction side of a power pump?

A—While little attention has been paid to the protection of the suction manifold and piping, a small relief valve may prevent considerable damage under certain conditions. There is little danger when a pump is in operation, but during standby periods faulty seating of some of the valves in a system



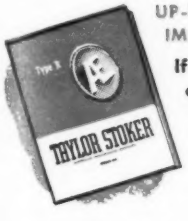
A typical 1947 installation of Taylor Stoker (Type R—capacity 240,000 lb./hr.) in a large U. S. Govt. heating plant.

The Taylor Stoker isn't "finicky" about what it consumes—its fuel-flexibility permits the use of a variety of types and sizes of coal, whatever is convenient for YOU from the standpoint of price, labor, delivery, mine location and any other cost lowering considerations you may have.

Cut combustion costs the Taylor Stoker Way. It's the fuel-flexible economy stoker.

WATCH THE TREND!

Throughout industry wherever underfeed stokers are discussed Taylor is first mentioned —the buyer's choice on original and repeat installations. That means *proved* performance.



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Honolulu P.O. Box 2755

may cause a damaging pressure on the suction side of a pump. If, for instance, the discharge stop-valve of a standby boiler feed pump leaks slightly, and this leakage seeps back through the discharge check valve and the pump valves to a tightly seating suction stop valve, under these conditions little additional water is required to raise the pressure in an already full system to full boiler-feed pressure. Danger of this condition developing may be eliminated by installation of the smallest relief-valve set at a safe pressure for suction piping and manifold.

Argument Corner

(*Continued from page* 124)

Both boilers are shut down at full pressure. Heat stored in them and their water is enough to supply the required cleanup steam and hot water at reduced steam pressure.

CHARLES J POULSON

Tacoma, Wash.

Get Advice Before Buying a Generator

I AM TAKING UP J M Evans' argument where he leaves off on the discussion of *DW's* 440-v generator in the Argument Corner, p 154, Dec 1946 POWER. I endorse everything that has been said, and in addition I say *DW* should take a set of indicator cards on the engine when it is running light, then a set of cards driving lineshafts and belts to determine the power used. After that, *DW* should spend some time making a study of plant operations and plot a load curve of average and maximum load conditions, and also take indicator cards with various load combinations.

With this information available, he should follow J M Evans' recommendation and consult an electrical engineer. The engineer will go right into the plant and lay out an installation to meet his special requirements. The problem involves too many assumptions that may be wrong to risk passing over them lightly.

The following experience illustrates what I mean:

A street railway company, needing additional power, signed a contract with a power company to supply a steady load of 4000 kw from 5 am to 9 pm daily. As the power company's feeders were 60 cycle, and the railway company's 25 cycle, a frequency changer

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1. Wide Selection of Corrosion-Resisting Alloys
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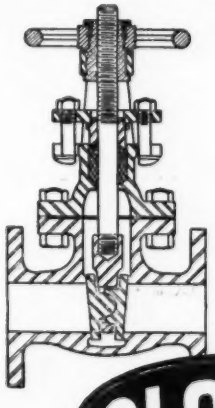
ALOYCO Valves and Fittings are made in a wide variety of stainless steels and other corrosion-resisting alloys. Each of these differs from all others in relative resistance to various corrosive fluids, under different conditions of temperature and concentration. It has taken us many years of specialization in the manufacture of corrosion-resisting valves, exclusively, to gain the experience which enables us to recommend the *one best alloy* for any specific application.

Of equal importance with the selection of the correct alloy, is the quality of design and construction of the valve. In pattern shop, foundry and machine shop, particularly, corrosion-resisting alloys require very different handling from all other metals. Here again, our concentration on corrosion problems makes Aloyco Valves distinctive for mechanical excellence. You get more out of Aloyco Valves, because we put more into them. Consult us on your requirements.

ALOYCO GATE VALVE NO. 111

• This popular valve has double-disc, ball-and-socket type wedges that are free to rotate and are non-fouling in any position. The design insures tightness on both seats and permits easy repairs.

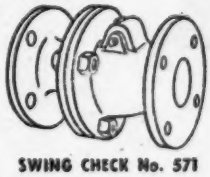


GLOBE No. 311

SERIES 300 GATE VALVE

ANGLE No. 331

GLOBE CHECK No. 45-A



SWING CHECK No. 571

FLUSH BOTTOM TANK No. 751

GLOBE No. 40-A

Y-FLANGED No. 361

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Built-in Motor Drive mounted on steel base is compact and easy to install. No foundations necessary.

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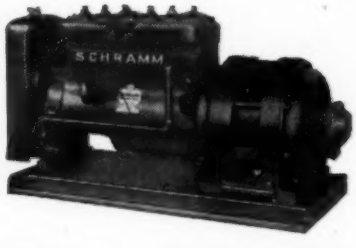
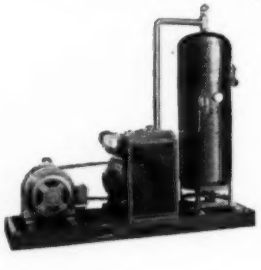
DIRECT MOTOR DRIVE WITH COOLING UNIT?

Schramm 300 cu. ft. displacement with direct-connected 50 H.P. motor with cooling unit on Steel Deck Base.



Or — **BELT DRIVE WITH TANK AND COOLING UNIT**

mounted and ready for immediate installation? Belt Drive complete with motor, vertical air receiver and cooling unit all mounted on a single base.



SCHRAMM offers you a complete line of Air Compressors for your every need! Sizes range up to 600 cu. ft. displacement! Schramm's stationary units are widely used in plants throughout the country, and are specified because they are vibrationless, lightweight, compact . . . and at the same time easily furnish a steady flow of air. Write today for full details on Schramm Air Compressors.

SCHRAMM INC
THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

was installed in the railway steam plant.

The power company's plant contained one 12,000 and two 4000-kw turbine-generators. Method of starting up the frequency changer was to slow down one generator and connect the frequency changer to it. The two units were then brought up to speed together.

To help start the frequency changer, a starting bar was made from a piece of 6x6-in. timber, with a hook to catch the end of an extra long bolt in the flanged coupling. When the starting switch was closed, four men would throw their weight on the bar and start the machine rolling.

One day during an overhauling job the motor leads were disconnected. A recent engineering graduate suggested that we tag the leads for identification. The foreman informed him that he knew how to hook up a motor and didn't need any college graduate to show him how. When the time came, he personally connected the leads and reversed them in the process. When the motor started it turned in the wrong direction. The four men promptly got off the bar, which was thrown through the air and crashed against the powerhouse wall. As good luck would have it, no harm was done.

H T Livingston
Los Angeles, Calif.

Centigrade to Fahrenheit

In my experience, conversion from Centigrade to Fahrenheit is required much more frequently than the other way round. You can do this calculation in your head by doubling the C temperature, subtracting 1/10th, then adding 32. For instance, 50 C doubled would be 100, less 1/10 would be 90, plus 32 would equal 122 F. This won't work so nicely, of course, on Fahrenheit to Centigrade.

San Francisco, Calif. P B Beggs

Horse-and-Buggy Days

The ice industry is given some unusual advice on page 126, Dec 1946 Power, to wit:

C W Parks tells the industry that "ice that is to be used directly in drinking water or food should be made from distilled water." Evidently Mr Parks is not familiar with modern raw-water ice plants, otherwise he would not recommend to the ice industry the use of an obsolete method of producing man-made ice.

Distilled-water ice plants have practically disappeared from the earth; no new plants of this type have been built in many years. As a matter of fact, ice made in the modern raw-water plant

when cable runs must "run the gauntlet"

a DELTABESTON* cable will give extra assurance of uninterrupted power

Conditions that shorten the life and threaten the performance of regular types of cable are often unavoidable around the power plant. But that's just where the chances of a cable failure *can't* be allowed to rise.

How can you maintain the same safety factor under *extra severe* conditions that you expect from standard power cable under normal conditions? The answer may lie in a DELTABESTON Cable of special construction, like the one shown here. It's one of many developed to "run the gauntlet" of unusual conditions for central stations and power plants.

Probably, this particular cable is *not* the one you'll need to meet your combination of conditions. In most cases, one of the regular Deltabeston types will do so. But remember that specialists in heat-resisting cable are always "on call" to select or even develop a Deltabeston construction that will maintain an adequate safety-factor for years to come.

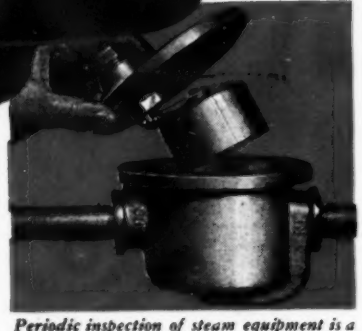
For further information, write Section Y55-263, Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Connecticut. Deltabeston Wires and Cables are distributed by G-E Merchandise Distributors.

* *Trade-mark Reg. U. S. Pat. Off.*

GENERAL ELECTRIC

HOFFMAN SERIES 600

INVERTED Bucket Traps FOR STEAM SERVICE



Periodic inspection of steam equipment is a maintenance "must" today. This Hoffman Bucket Trap can be opened up, examined and put back into service with a minimum of time and effort.

STURDY.. COMPACT..EFFICIENT . . . only begin to describe this newest achievement of Hoffman engineers. Designed to meet the exacting requirements prescribed by varied applications, the Series 600 Hoffman Inverted Bucket Trap *assures high operating efficiency because of its simplicity.* It is so constructed that all working parts are mounted on the bonnet—*easily removed for cleaning without breaking pipe connections.* All parts subject to wear are of stainless steel—can be easily and inexpensively renewed.

By a simple change in valve seats, the Series 600 Trap is adjustable to a wide choice of pressures—another design feature that provides wide versatility in applications of each unit. Available for steam pressures up to 200 lbs.—capacities to 4450 lbs. water per hour.

Send today for your copy of the new Hoffman Series 600 Bulletin.

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Makers of Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems.
Sold by leading wholesalers of Heating and Plumbing Equipment.

is just as pure biologically and often more so than distilled-water ice.

What about the ice that is made in domestic machines? None of these refrigerators produces distilled-water ice, yet the ice cubes are used almost entirely in contact with food and drinks.

Thousands of tons of pure raw-water ice are produced annually in America and without the use of distilled water to fill the cores. Distilled-water ice belongs in the horse-and-buggy age.

Atlanta, Georgia C T BAKER

Compressed-Air Fires Solved in Africa

IN NOV 1946 POWER, PAGE 120, a contributor to Reader's Problems raised the question, "What Is the Cause of Compressed-Air Explosions?" I refer you to a discussion in *Journal of the South African Institute of Engineers,* Volume 21, No. 9, April 1923, entitled, "Explosions in Air Compressors."

The proceedings, as mentioned above, were issued as a paper by the Prevention of Accidents Committee of the Rand Mutual Assurance Co, Ltd, Johannesburg, Transvaal.

This discussion provides the most complete data that I have yet found on the question of compressed-air explosions. Although the report is somewhat lengthy, I believe the pertinent points might be of considerable interest to a large number of POWER readers. Formation of carbon in compressed-air piping has, I believe, not been fully appreciated. Ignition of this carbon can cause serious trouble. In a small compressor installation of only 200 cfm, 100 psi, I have actually seen a red-hot spot moving along the pipeline. This phenomenon resulted from the ignition of carbon which had formed in the piping and, once ignited, the compressed air served to maintain combustion. It so happened that the operator in this plant had seen the paper, which I referred to above, a few days before, and immediately shut down his machine. I had always believed that such a phenomenon could occur only in large installations, and had not conceived it possible that it would occur in a plant small as the one mentioned.

Montreal, Que. R S GRIFFITH

Slide Rule Does the Trick

FOR COMPARISON of thermometers use following slide-rule conversion method:

C scale	5	Read Centigrade
D scale	9	Read Fahrenheit — 32

DOWELL

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

Do your water lines look like this?

Clean water lines quickly, economically, safely the chemical way!

When efficient operation of water lines is the goal—when a full, free flow of water means something in dollars and cents, Dowell's *chemical* cleaning service merits careful consideration.

The modern, tested Dowell method for quickly and safely removing accumulated scale and sludge has proved effective in water lines everywhere—underground—above ground—indoors or out. Dismantling is unnecessary—even small lines complicated by bends, elbows and valves have been restored to designed capacity. The lines are filled through the regular connections with specially selected liquid solvents designed to dissolve and disintegrate the scale and sludge.

Leading railroads, utilities and other industries rely upon Dowell service engineers to perform the entire cleaning operation—bringing with them adequate equipment—special truck-mounted tanks, pumps, mixers, heaters—to control every stage of the successful job. Ask for free booklet—"More Power to America's Industry!" Illustrated in color, it shows how Dowell specialists chemically clean water lines, steam generating equipment, heat-exchangers and many other types of equipment.

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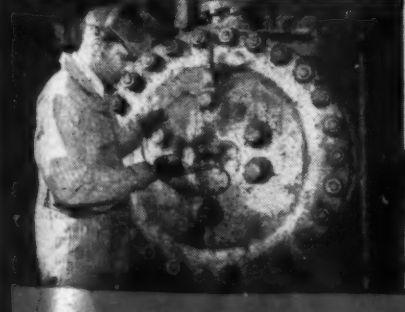
Long Beach, Casper: Dowell Associate—International Cementers, Inc.

Dowell's industrial engineers are thoroughly experienced in successful chemical cleaning. They are supported by the full research and technical resources of Dowell's own laboratories.

Dowell's field equipment includes the most modern types of scientific devices. Solvents for Dowell chemical scale removal service are mixed especially to fit each individual job.

FREE SHOWING! *New 18-minute sound slide film illustrating the possibilities of Dowell Chemical Scale Removal Service. To arrange a special showing call or write Dowell.*



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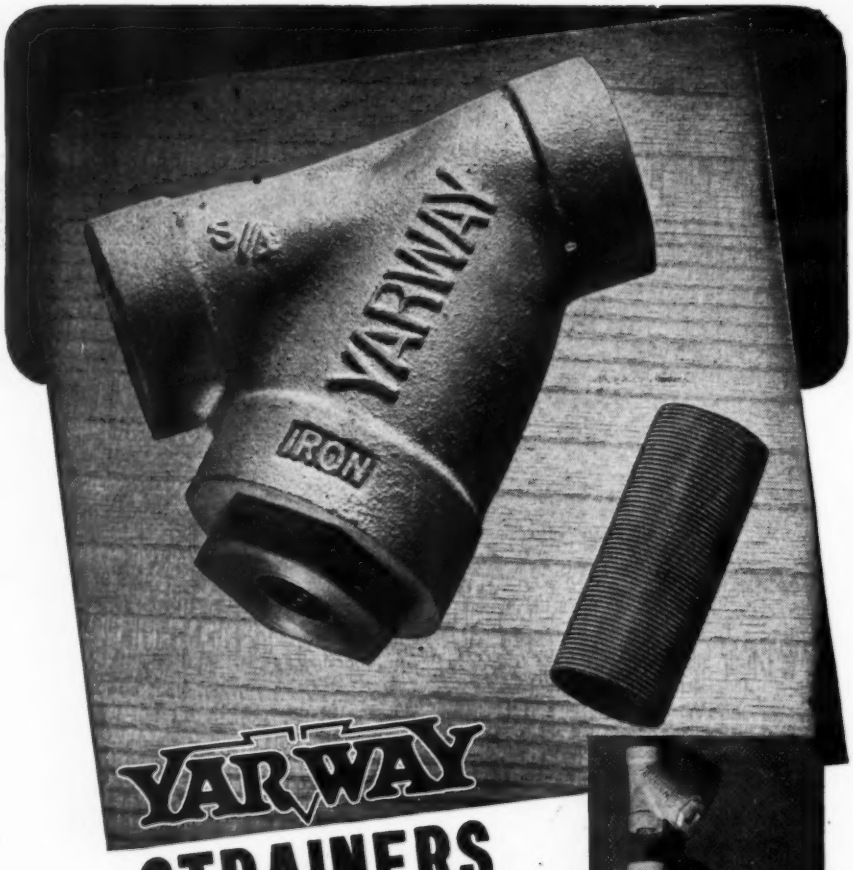
FOR INDUSTRIAL CHEMICAL SERVICE



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"Police the Pipelines"

YARWAY STRAINERS are *selling by the thousands* because they are better engineered for the service.

"The Screen is the Thing"—a high-grade, woven Monel wire screen that stops the dirt, lets fluids flow freely.

Then, too, purchasers like the *body finish —Cadmium plated* for protection against corrosion and for better appearance.

And last but not least, it is *"Easy to Clean"* having a steel blow-off bushing, precision machined with straight thread. Screen and bushing come out together—go back together, automatically aligning.

Six sizes, ½" to 2" for pressures up to 600 lb serve practically all strainer needs.

Sold by over 100 Mill Supply Houses. See your Supply House or write for Bulletin S-201.

YARNALL-WARING COMPANY
100 Mermaid Avenue PHILADELPHIA 18, PA.

YARWAY STRAINERS

Example: Change 212 F to Centigrade. Set 5 on *C* scale at 9 on *D* scale; set indicator on 180 *D* scale and read 100 on *C* scale, directly above. Buy a $1 slide rule, and study John King's valuable slide-rule articles in POWER, under "Math Tips."

Pittsburgh, Pa. H E FISHER

Use Simple Equation On Thermometer Scales

I WISH TO PRESENT another method for converting Centigrade to Fahrenheit scale, and vice versa. The following is a formula I believe to be the simplest and easiest to remember because it is based on the following facts.

Between the freezing and boiling points of water on the Centigrade scale there are 100 degrees, thus we can remember C/100. Freezing point on the Fahrenheit scale is 32 degrees higher than it is on the Centigrade scale. There are 180 degrees between freezing and boiling points of water on the Fahrenheit scale; thus we have and remember F-32/180, then the formula

$$C/100 = F-32/180$$

Example 1: Convert 40 C to Fahrenheit degrees. Equate $40/100 = F-32/180$. Solving for F. $72 + 32 = F$, or 104 degrees.

Example 2: Convert 77 F to Centigrade degrees. Set $C/100 = 77-32/180$. Solving $C = 45/180 \times 100$, we get $C = 25$ degrees.

Chicago, Ill. W W BELL

Eliminate One Step in Thermometer Conversion

I READ WITH INTEREST S C Marshall's letter in the Argument Corner, p 154, Dec 1946, POWER, relative to his method for converting Centigrade to Fahrenheit, and vice versa. He mentioned that he would like to hear from some one who knew a simpler method.

The method I use eliminates one step simply by utilizing the freezing point on both scales as the basis for the conversion, namely 0 C and 32 F; otherwise the method is similar.

For example: To convert 100 C, multiply 100 by 9/5, which gives you 180; then add 32, the result, 212 F, being the boiling point Fahrenheit. In the reverse order to change 212 F to C, subtract 32 from 212 or 180, and then multiply by 5/9 or 100.

I find this the simplest method as 32 is an easy figure to remember; it is the freezing point on the Fahrenheit scale.

Sharon Hill, Pa. D B ROBERTS

Find out how NONPAREIL TURBINE OIL **can save money . . . even before it starts operating**

PERHAPS you haven't thought of turbine oil as part of the turbine installation problem at this stage of your planning. But there is one oil that differs so much from other turbine oils that its use affects your plans all the way back to the drafting board. This oil—Nonpareil Turbine Oil—brings real economy in auxiliary equipment, in plant space, and in total investment.

Nonpareil Turbine Oil is guaranteed for the life of your turbine. That's not merely a way of saying "Nonpareil is a long-lasting oil." It means that Nonpareil should be considered as part of your turbine investment just as much as the auxiliary equipment which goes with the turbine. Here's why:

1. Less space is required for a turbine and its auxiliary equipment when Nonpareil is used. One fill of oil is all that is needed for each turbine. No space is needed for extra storage tanks or batch treating and settling tanks.

2. Less equipment is needed, such as pipes, fittings, pumps and tanks usually required where oil must be treated.

3. Lower operating and maintenance costs because there is less equipment to maintain.

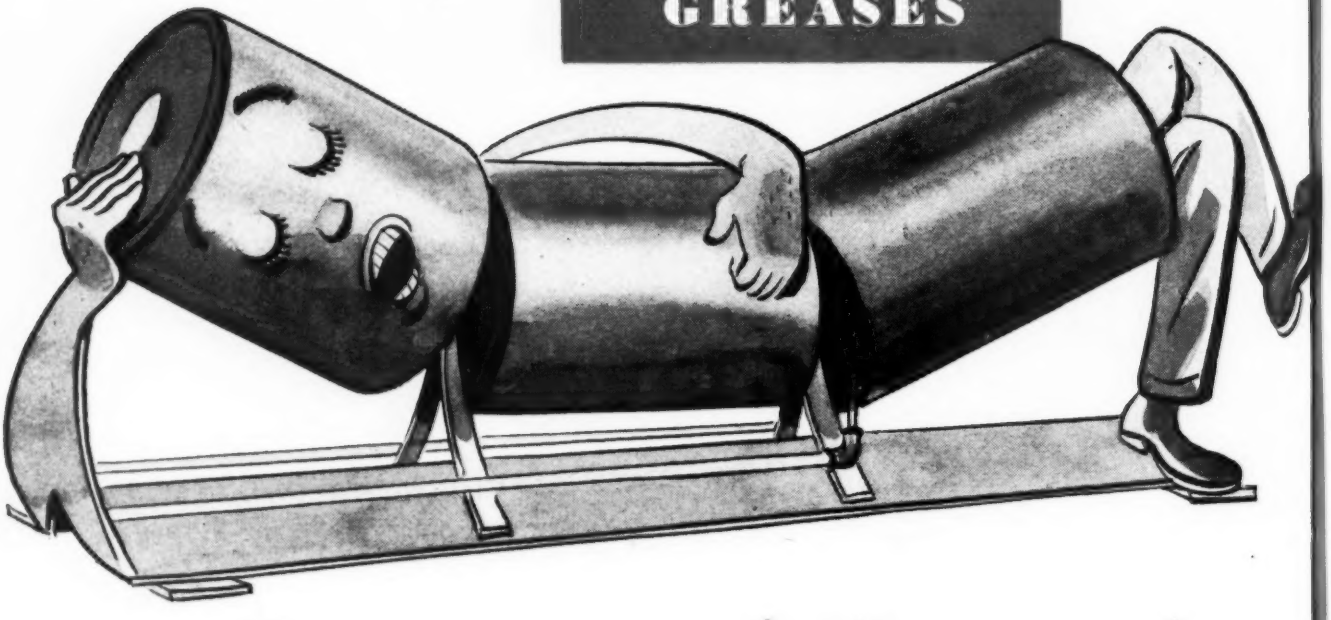
Take time now to consider the benefits offered by Nonpareil Turbine Oil which are covered by written guarantee—that it eliminates turbine oil maintenance, and deposits caused by oil deterioration. Test it in one or more of your present units. You'll be convinced it's the oil you want to match the new, efficient generating equipment you install.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for a Lubrication Engineer to help you make the test.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

Wake up idle idlers with

SUPERLA GREASES



Save power... belts... and material-handling time on conveyors

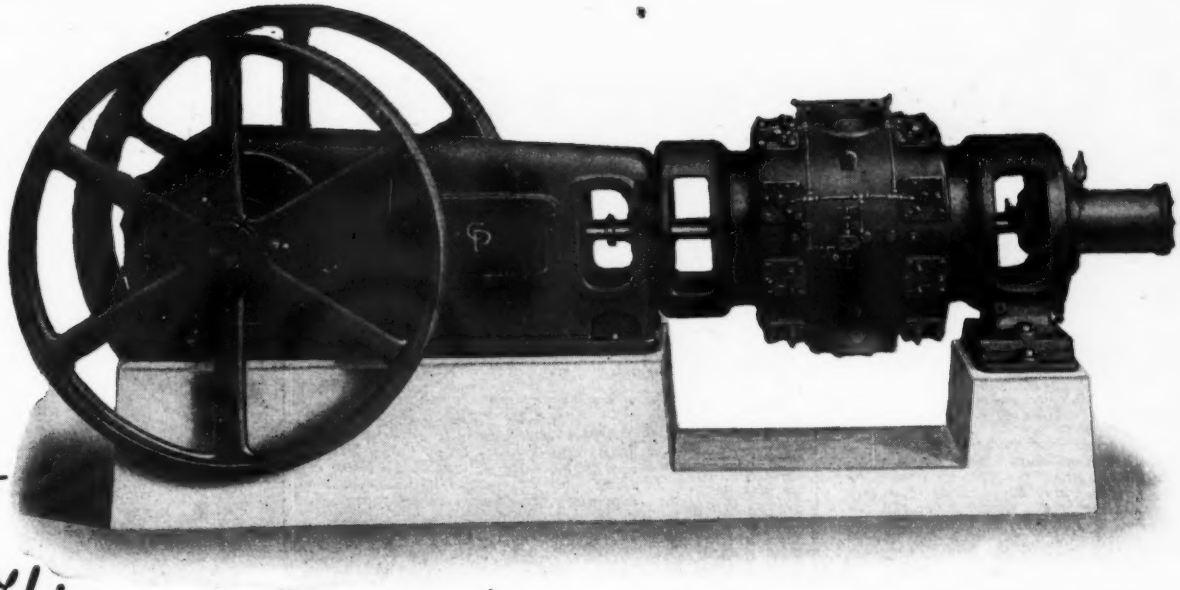
ARE CONVEYOR IDLERS slow to start up in cold weather? Do they heat up, throw off grease, and run dry when the weather's hot?

A change to a better lubricant may make these lazy idlers carry their share of the load—and incidentally save on power, belt wear, and material-handling time.

Superla Greases are ideal for idlers. Grades are available that permit idlers to turn readily at low temperatures, yet these lubricants do not thin out or separate when normal operating temperatures are reached. Where temperatures are above normal (over 175°F.), Superla X Greases resist separation and oxidation, and have good sealing quality.

A Standard Oil Lubrication Engineer will gladly help you make a test. Standard Oil Co., (Ind.), 910 S. Michigan Ave., Chicago 80, Ill.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE



This
COMPRESSOR

...delivers oil-free air

For uses where compressed air or gas must be free from oil, CP Oil-less Cylinder Compressors are ideal, since they require no oil, grease, or other cylinder lubricant.

Piston and rod, completely supported by crossheads, are full floating, removing all weight from cylinder walls and stuffing boxes. Thus long life of carbon piston rings is assured. Normal maintenance only is required — no need for periodic rotation of piston rings.

CP Oil-less Cylinder Compressors, arranged for belt, motor, or steam drive, are made in single and two-stage types, available in a wide range of sizes and ratings. Write for full information.

CHICAGO PNEUMATIC TOOL COMPANY
General Offices: 6 East 44th Street, New York 17, N. Y.

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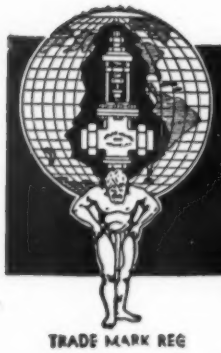
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



ATLAS

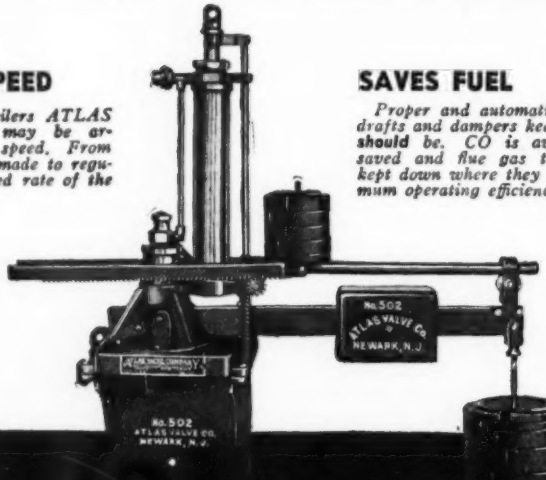
TRADE MARK REG

CONTROLS SPEED

On forced draft boilers ATLAS Damper Regulators may be arranged to control fan speed. From the fan they may be made to regulate indirectly the feed rate of the stokers.

SAVES FUEL

Proper and automatic adjustment of drafts and dampers keeps CO_2 where it should be. CO is avoided. Fuel is saved and flue gas temperatures are kept down where they belong for maximum operating efficiency.



Damper Regulators

ATLAS Damper Regulators are recommended for use where correct steam pressure is important, as follows:

For low pressure boilers we recommend No. 501 which is suitable for automatically regulating drafts on vapor or low pressure steam heating boilers. Can be adjusted to operate at any steam pressure up to 25 pounds.

For medium pressure boilers we recommend No. 502, pictured above. For pressures up to 150 pounds. Will move damper on boiler pressure changes of ¼ pound.

For high pressure boilers we recommend No. 503. This regulator has a Cast Iron Base construction for boiler pressures up to 250 pounds. Cast Steel Base construction for boilers up to 400 pounds. Will move damper on ½ pound boiler pressure variations.

ATLAS Damper Regulators are automatic—hydraulic—sensitive—easy to install. Water pressure is made to act automatically on a piston which is connected to draft doors or dampers by chain. Ample power is thus available for moving the heaviest doors or dampers. At the same time the control piston responds to slightest variations in steam pressure so that uniform pressure is maintained through closest adjustment of dampers and a resulting steady rate of combustion.

ASK for BULLETIN 4-A

This Bulletin explains why ATLAS Damper Regulators are so valuable on boilers of practically every type and size. For other ATLAS power plant products check the list below, clip out, attach your name and address, and you will hear from us promptly.

☐ Please send Bulletin 4-A. Also please send information on the following ATLAS products—

☐ Campbell Boiler Feed Water Regulators
☐ Temperature Regulators
☐ Reducing Valves
☐ Exhaust Control Systems
☐ Pressure Regulators
☐ Pump Governors
☐ Float Valves
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REGULATING VALVES FOR EVERY SERVICE

Specialists in Regulation for Nearly a Half Century

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Representatives in Principal Cities

Reader's Problems

(*Continued from page* 113)

Prime Mover Is Too Small

NEGLECTING GENERATOR and exciter losses the waterwheel output at 4100 kw is 5500 hp or 93% of the waterwheel rating. Prime movers are generally built with some margin above rating. Some drop in wheel output may be due to low head or decreased efficiency as result of wear. Generator requires nearly 7000 hp to carry 5000 kva at unity power factor, so the waterwheel is not powerful enough.

Moderate changes in power factor or voltage will not affect the kw output if waterwheel input remains the same. *JAL* should note that the 80% pf rating of the generator reduces output to 4000 kw although generator would deliver 5000 kw at unity power factor if sufficient power was available.

Salt Lake City, Utah R V SELANDER

Try Dividing Load

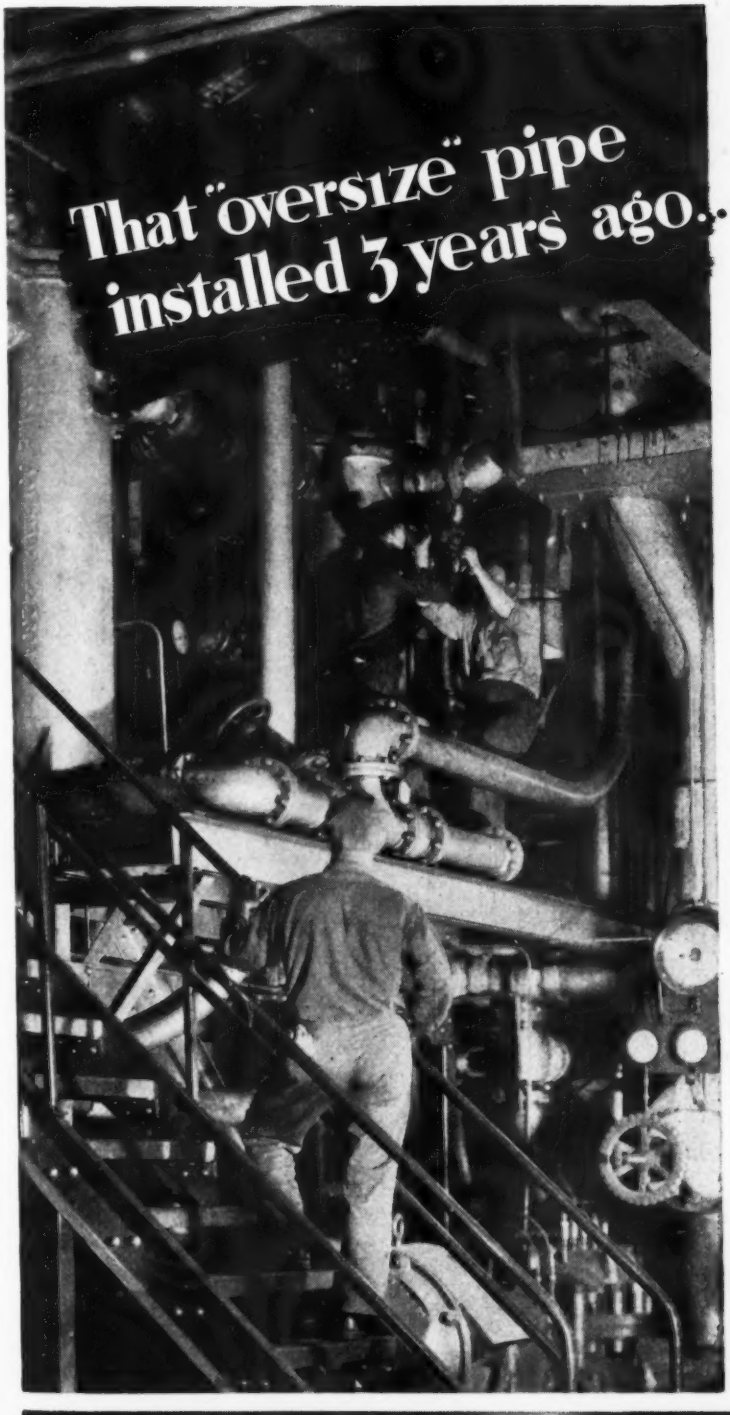
IT IS MY BELIEF THAT JAL is obtaining full rated output from his waterwheel because 5900 hp equals 4400 kw.

This 4400 kw represents the equivalent power that the waterwheel is supplying to the generator. To transform this power to value obtained at the generator terminals, assume an efficiency of 93.3% at full load. Therefore, power output of generator, when it is supplied with 5900 hp would be equal to 4100 kw, which is the maximum output, unless efficiency of generator or power supplied can be increased.

Power available from *JAL's* generator. at the power factors he obtains, assuming that sufficient power were supplied, would be 5000 kva or 4850 kw. Generator output is not usually rated in kw but in kva since the voltage allowable is determined by machine design and current by real or actual power output, which may vary from 0 watts at 0 pf to the product of the volts and amperes at unity power factor.

Real power, not apparent power, determines power supplied by the waterwheel. At a very low power factor, generator might be operating at full rated output of 5000 kva and only a small amount of real power, possibly 500 kw. Waterwheel would then be operating far below rated capacity. As the power factor is increased, the waterwheel would approach full load, assuming the

INSTALL STEEL PIPING ADEQUATE FOR TOMORROW'S NEEDS



That "oversize" pipe installed 3 years ago...takes care of the new extension

THE owner of an eastern food plant is congratulating himself on what he had always thought was an extravagant, though necessary investment. A few years ago, when he installed new processing equipment, the only pipe he could secure quickly was what he thought was "oversize." But he put it in.

Now greater demand for his product is leading him to increase his plant capacity. One thing he isn't worrying about is his piping system. That "oversize" pipe of 3 years ago is adequate to handle the extension. Today he *knows* it was an excellent investment.

Too many owners--and contractors, too--are inclined to rely on minimum pipe sizes--not anticipating that what's barely adequate now may soon be completely inadequate. Remember--it's long run economy to install steel pipe adequate to do a job today AND TOMORROW.

Distributors in all industrial markets handle Youngstown pipe in a wide range of sizes.

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

GENERAL OFFICES - YOUNGSTOWN 1, OHIO

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Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Pipe and Tubular Products-Sheets-Plates-Electrolytic Tin Plate-Coke Tin Plate.

Conduit-Bars-Rods-Wire-Cold Drawn Carbon Steel Rounds-Tie Plates and Spikes.

In his business — just like yours these days — he is always running out of supplies and parts he needs in a hurry. Yet customers have to be satisfied.

Well, he doesn't have a nervous breakdown. He doesn't lose customers. Instead, he gets *what* he needs *when* he needs it by specifying Air Express delivery.

"Air Express," he said, "is like reaching out to any supplier's warehouse *wherever* it is — and picking up just what's wanted. Air Express puts the most distant suppliers *right next door.*"

Specify Air Express - it's Good Business

- Low rates. • Special pick-up and delivery at no extra cost.
- Direct by air to and from principal U. S. towns and cities.
- Air-rail to 23,000 off-airline communities.
- Direct air service to and from scores of foreign countries.

Just phone your local Air Express Division, Railway Express Agency, for fast shipping action . . . Write today for Air Express Rate Schedules containing helpful shipping aids. Address Air Express, 230 Park Avenue, New York 17, N. Y. Or ask for them at any Airline or Railway Express Office. Air Express Division, Railway Express Agency, representing the Airlines of the United States.

AIR EXPRESS

AIR EXPRESS

GETS THERE FIRST

Rates are low

To Air Express a 5 lb. package 1349 miles costs only $2.32! Heavier weights similarly inexpensive. Investigate!

generator is continually operating at 5000 kva. The condition where both waterwheel and generator would be operating at full load would be reached when the power factor was about 82%. Real power output of the generator would be 4100 kw, which would fully load the waterwheel. Apparent power output of generator would then be 5000 kva, which is full load on generator.

JAL might find it more to his advantage to study demand peaks and endeavor to stagger his maximum demands as much as possible.

Other remedies, which are more expensive, are: (1) Divide his load into small units so only those absolutely necessary need be kept in operation. Individual motors on each piece of equipment, rather than large motors with belt drives to the various pieces of equipment, are examples. (2) Transmit power at a higher voltage, by the use of transformers, to reduce the line current directly and the power lost in the line. (3) Install an auxiliary generator set to use at time of peak-load demands. Diesel-, gasoline-, steam- or water-driven prime mover and generator of sufficient size could be used to carry the excess load when the main unit is operating at full load. (4) Use standby service from another plant or a public utility to help carry peak loads.

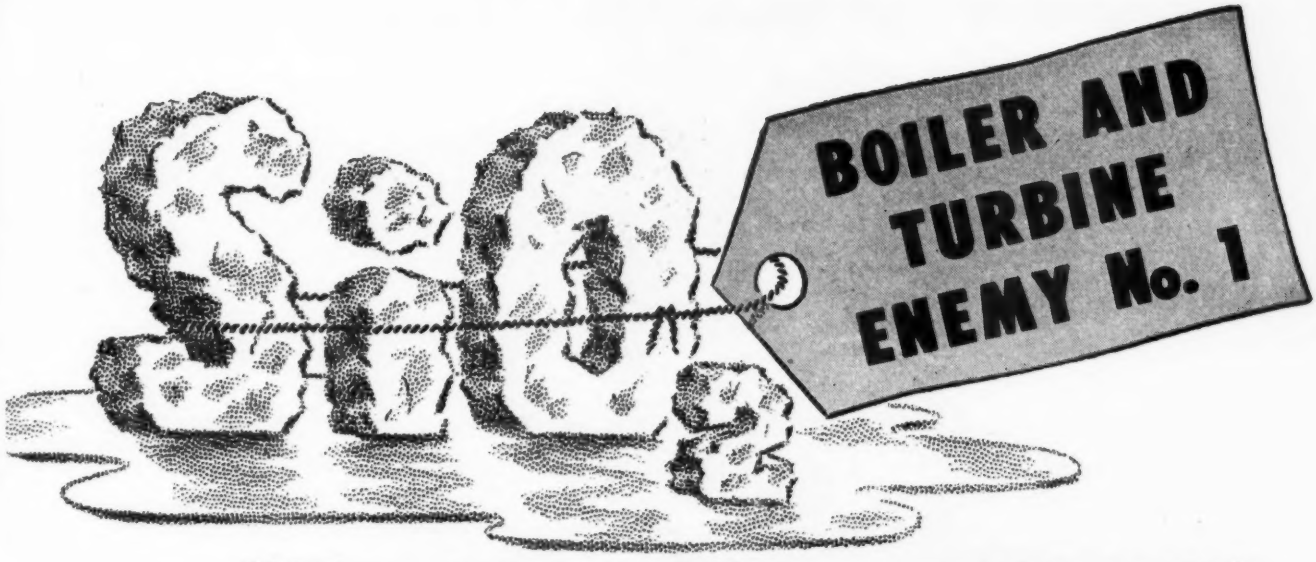
Somerville, Mass. J P HOAR

Northwestern Schedules Air-Compressor Research

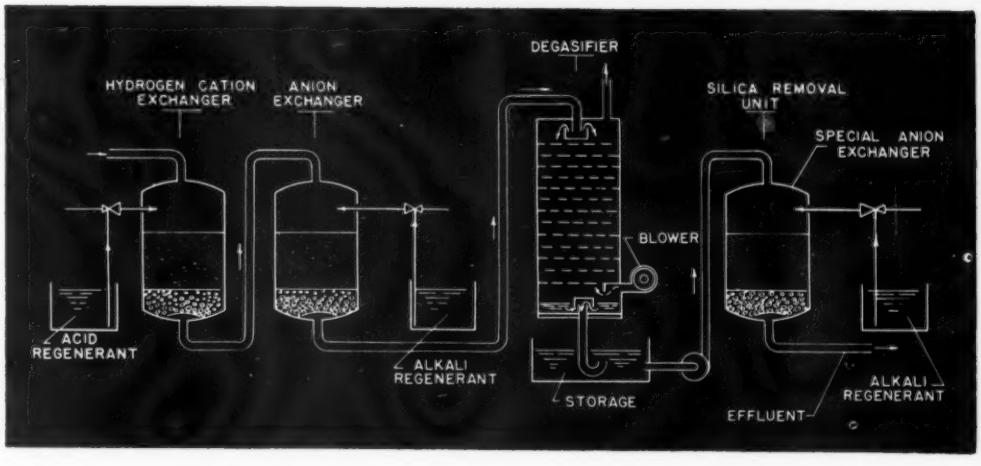
Northwestern University Technological Institute announces a $30,000 program of research in development of air compressors for use in gas turbines, which, when perfected, may become future source of energy production for airplanes, locomotives, ships and power plants of the future. However, two "bugs" have limited its effectiveness. First, researchers have been unable to devise a means of compressing large quantities of air efficiently for use in the turbines. Second, the extremely high temperatures—about 1500 F—which must be maintained in the turbines for efficient operation, cause their rotating metal blades to become white hot and to weaken.

At Northwestern an attempt will be made to construct compressors that will overcome the first difficulty. The second may be eliminated soon by research engineers who are at work in various laboratories throughout the country developing new alloys that will withstand high temperatures.

The Northwestern program, financed by Navy's Office of Research and Invention, will be directed by Prof Burgess H Jennings, chairman of mechanical engineering dept. I T Wetzel and William Roberts of the dept's faculty will participate.



. . . "liquidated" by LIQUON



To prevent silica deposits in boiler tubes and on turbine blades, the concentration of silica in the steam must be kept below 0.1 ppm, especially in high-pressure plants. This usually means a silica of under 5.0 ppm in the concentrated boiler water.

If you have a silica removal problem, consult the LIQUON engineers. The advice of these recognized authorities in water treatment gives you the benefit of 30 years of specialized experience. From this long experience has been developed not merely one . . . but FOUR . . . proven LIQUON methods of silica removal . . . your assurance of the most effective and economical method for your individual plant conditions. Write for Bulletin 7 for further information.

If you will write us about your water treatment needs, we shall be glad to send you bulletins describing suitable LIQUON methods and to offer recommendations without obligating you in any way.

Remember, too, that whatever your water supply quality difficulties may be — hardness, alkalinity, turbidity, gases, or other impurities — LIQUON can give you exactly the right process, equipment and materials, because LIQUON's services cover the entire field of liquid conditioning.

LIQUID CONDITIONING CORPORATION
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Engineering Service Representatives in Principal Cities

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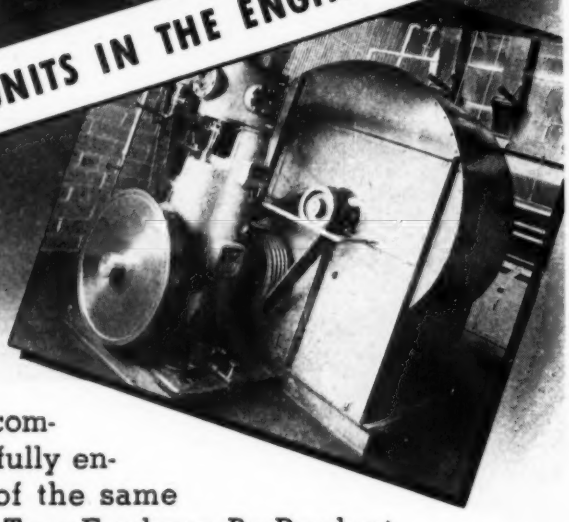
EVERY PROCESS. EVERY TYPE OF EQUIPMENT
for conditioning of water and other liquids

TROY-ENGBERG
STEAM ENGINE

By-Product Power

1 POWER for your stokers, generators, pumps, compressors

2 HEAT UNITS IN THE ENGINE EXHAUST



And both accomplished by skillfully engineered use of the same steam. This is Troy-Engberg By-Product Power at work.

Use the modern Troy-Engberg Steam Engine to drive stokers, blowers, fans, compressors, mixers, generators and pumps—THEN use the exhaust from the engine for your processing or heating, or both.

Cut Power Costs by putting your steam fully to WORK. Write us for detailed information on applying Troy-Engberg By-Product Power to your plant.

Send for Bulletin 306

TROY ENGINE & MACHINE COMPANY
Established 1870
2524 Railroad Avenue Troy, Pennsylvania

TROY-ENGBERG
STEAM ENGINES • GENERATING SETS • GENERATORS

Power News

(*Continued from page* 138)

become competitive in fields that hitherto have been regarded as unable to compete in this region.

"This Committee believes, however, that in the foreseeable future, it is not likely that atomic power will replace present sources but it is probable that atomic-power plants will soon supplement our present facilities for producing electric power.

"Many factors will affect the speed with which the commercial utilization of the atom as a source of power will come about. Assuming proper and adequate financial support by the government of research and development, assuming prompt and full release of technical information commensurate with security, and provided that industry be given the green light to proceed with its own developments, it seems probable that within five years atomic piles could be operating for the purpose of producing electric power."

The Committee is of the opinion that "Because we have in New England a greater concentration of research facilities of a diversified nature than has any other region of the country," New England definitely can serve in the development of atomic energy for industrial purposes. "Our educational institutions with their science and engineering staffs, the medical schools and hospitals, the engineering, construction, and consulting firms, our existing power-producing companies, and the power-consuming industries of New England, all have their parts to play, their contributions to make, in this potentially great new development.

"The nature of the field makes it impossible for more than a few organizations or cooperative groups to be actively engaged in the research and development stages of atomic problems. It should be possible and it is probably desirable, however, for each interested concern or institution to assign one or two technically trained men to keep in touch with developments in order that they be prepared to make proper use of them at the appropriate time."

Hope Natural Gas Co, Clarksburg, W. Va., has applied to the Federal Power Commission for permission to construct additional natural-gas transmission facilities in 1947 and 1948. New facilities will enable the company to receive larger quantities of gas from the Tennessee Gas and Transmission Co. Present deliveries total a maximum of 115,000,000 cu ft a day.

ASBESTOS IN ACTION

Structural materials that always stay young...

K&M "Century" FLAT ASBESTOS-CEMENT SHEET MATERIALS

Design and construction by the Austin Company

• For rugged strength and staying-power, K&M "Century" Flat Asbestos-Cement Sheet materials are unbeatable. K&M Standard Asbestos Lumber and K&M Monobestos are two such products that grow *tougher* with age, never need maintenance, and practically last forever.

The most recent addition to the "Century" Flat Asbestos Sheet family is K&M "Century" APAC—a sturdy, light-weight material that's highly resistant to the common enemies of most building materials. Fire, rodents, termites, weather, rot . . . APAC withstands them all, and seems to stay eternally young. Its 4′ x 8′ sheets are ideal for many types of industrial construction, such as walls, partitions, ceilings, elevator shaft linings—in fact APAC has as many uses as a building has surfaces.

K&M "Century" Flat Asbestos Sheet Materials hold the right answer to many construction problems. Write to us for full information on what they can do for YOU.

K&M best in asbestos

Nature Made Asbestos..
Keasbey & Mattison has been making it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA.

HEAT AND PURIFY *Feed Water* AT LOWER COST

• Stickle Open Coil Feed Water Heaters and Purifiers are available in heating capacities to meet desired requirements. 10 standard sizes of Single Heaters supply heating capacities of 3,000 lbs. to 130,000 lbs. per hour with standard storage. (Extra storage capacity when required.) Six standard sizes of Dual Heaters with heating capacities from 30,000 lbs. to 250,000 lbs. per hour. Storage space to meet needs.

A Stickle Open Coil Feed Water Heater With Capacity to Meet Your Needs

Examples of Stickle Single and Dual Heaters built for industries. Heater construction, choice of cast iron or steel.

Superior Open Coil Design

Stickle Heaters bring water into direct contact with steam; provide instantaneous transmission of heat; deliver feed water to pump within two degrees of temperature of saturated steam in heater. Tray system (open coils) composed of series of three-section sets easily removed and replaced. No tray overflow—scale-forming substance does not accumulate on heater side walls.

Purified Feed Water

Stickle Heaters eliminate scale-forming substances and injurious gases. Boiler feed supply increased in purity by addition of steam condensed in heating—representing fully one-sixth of total supply.

Automatic Control

Admission and overflow controlled by two automatic floats.

Complete Information and Data

Bulletin No. 117 supplies design and construction information and illustrates various sizes and types of Stickle Heaters, mailed on request.

OTHER STICKLE EQUIPMENT

Stickle Open Float Steam Traps—Four series designs to meet specific operating conditions. Specify use in requesting bulletin.

Stickle Regulating and Reducing Valves—Two series—single seated, balanced; double seated, semi-balanced. Each in three standard types. Sizes small to large. Bulletins Nos. 235 and 435.

Stickle Differential Drainage and Boiler Return System—A closed pumping system for increasing boiler capacity and reducing fuel cost. Bulletin No. 250.

Stickle

STEAM SPECIALTIES COMPANY

2265 VALLEY AVENUE • INDIANAPOLIS, INDIANA

Power News

(*Continued from page* 140)

of the National Defense Research Committee, which later became Office of Scientific Research and Development, and which, throughout the war, passed upon Government's vast scientific development program that led, among other things, to the atom bomb, proximity fuse, radar development, etc. Since appointment of the Atomic Commission last October, Wilson has been acting as one of its small staff of consultants.

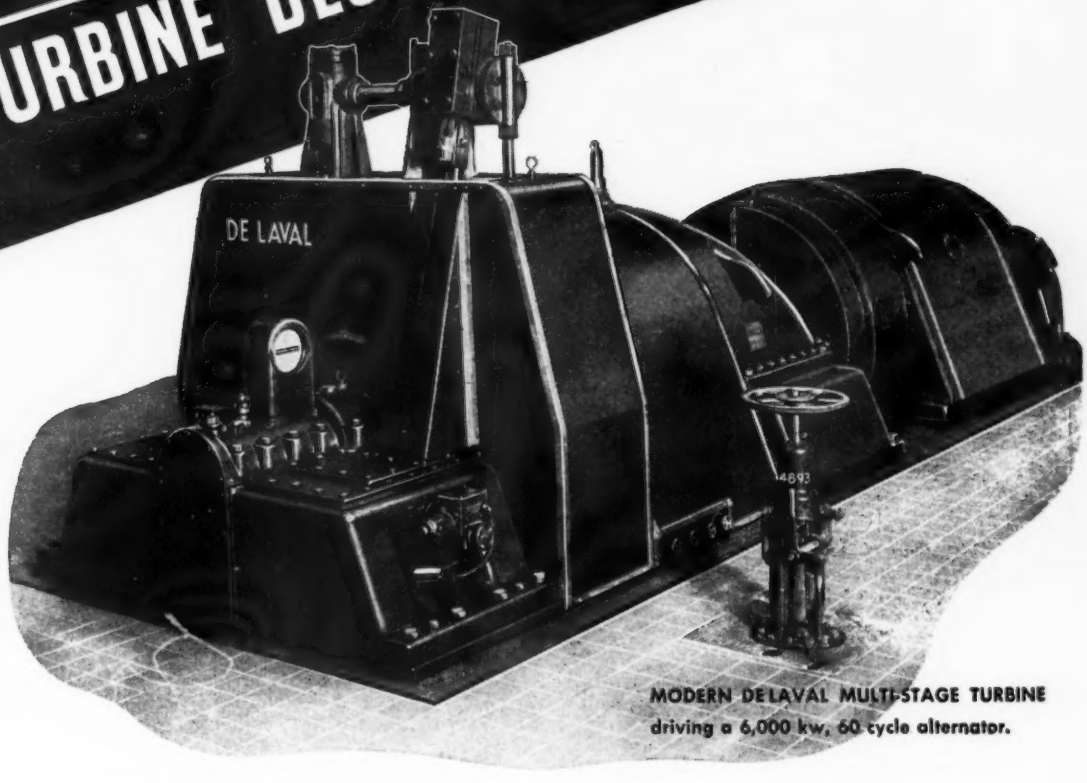
With transfer of all authority, property and personnel to AEC, Manhattan District formally dies. Its chief, Maj Gen Leslie R Groves, shifts to one of two assistants to the chief, U. S. Army Engineers, a post to which he was appointed last summer. He is expected to retire shortly from active duty. Other military personnel of Manhattan District temporarily are shifted to AEC to continue in administrative and executive capacities until new personnel can be selected. Under the Atomic Energy Act from which AEC derives its authority, military personnel will remain permanently active in the atomic field only in AEC's Military Applications Division, one of four operating segments of the new agency; the others are research, engineering and production.

Austin Field Pipe Line Co of Detroit, Mich., has filed an application for a certificate of public convenience and necessity with Federal Power Commission authorizing construction of facilities required for transportation of natural gas from Austin and Reed City gas-storage fields near Big Rapids, Mich., to city gates of Mt. Pleasant, Ann Arbor and Detroit, Mich. Facilities consist of pipelines and a compressor station and will be operated by Michigan-Wisconsin Pipe Line Co in latter's service of natural gas to various districts of Michigan Consolidated Gas Co.

West Penn Companies announce establishment of memorial scholarships to commemorate 15 employes who sacrificed their lives during World War II. These memorial scholarships are to be awarded to sons and daughters and younger employes of the companies. This year a total of eight memorial scholarships will be available—two for one year, two for two years, two for three years, and two for four years, each providing $500 per year toward cost of a college education. Beginning with 1948, two memorial scholarships will be available annually, good for a period of four academic years. Selection of recipients of these scholarships will be determined by competitive examinations conducted by a recognized, impartial agency.

FIRST COMMERCIAL TURBO-GENERATING SET IN AMERICA
De Laval generating set exhibited at Columbian World's Fair, Chicago, 1893.

A HALF CENTURY OF PROGRESS in TURBINE DESIGN by DE LAVAL



MODERN DE LAVAL MULTI-STAGE TURBINE
driving a 6,000 kw, 60 cycle alternator.

The highly perfected De Laval turbines of today are the direct result of the early achievements of Dr. De Laval, who in the year 1888 made the impulse type of turbine a practical and efficient power-producing machine by his invention of the diverging nozzle now employed in all impulse type turbines . . . For steam turbines of all types and sizes, consult De Laval.

T-1

TURBINES · HELICAL GEARS · WORM GEAR SPEED REDUCERS · CENTRIFUGAL PUMPS · CENTRIFUGAL BLOWERS AND COMPRESSORS · IMO OIL PUMPS

DE LAVAL STEAM TURBINE COMPANY
TRENTON 2, NEW JERSEY

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RODA

High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

DENDRON

High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA

High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX STOKER

A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

COKE

Roda and Stonega from Wise County, Va., and Connellsville Coke from Pennsylvania.

CRITERION COAL

High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER

Genuine Third Vein Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

LYNCO

Medium volatile, high fusion coking coal for by-product and steam use from Wyoming Co., W. Va., on Virginian Ry.

Old Kentucky

Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

CHARMCO

Unexcelled Steaming Coal from the Fire Creek Seam in Greenbrier County, W.Va., originating on the N.F.&G.R.R.

ANTHRACITE — Hazle Brook Premium . . . Raven Run

General Coal Company

123 SOUTH BROAD STREET, PHILADELPHIA 9, PA.

BRANCHES:

BLUEFIELD, W. VA. BOSTON BUFFALO CHARLOTTE, N. C.
CINCINNATI DETROIT NEW YORK NORFOLK PITTSBURGH

N L Smith Becomes Chairman of FPC

Shift in chairmanship of Federal Power Commission represents an internal move within the Commission to present its best front to the incoming Republican Congress. Nelson Lee Smith, New Hampshire Republican member, replaces Leland Olds, who resigned. Long a target of criticism by GOP Congressmen, Olds was subjected to particularly caustic questioning as to his views on valley authority proposals by minority members of House Appropriations Committee last spring. FPC's appropriations for the current fiscal year, as finally approved by the last Congress, also fell considerably below the commission's request.

Olds' resignation, which had been predicted for several months, left political complexion of Commission's membership unchanged, with three Democratic and two Republican members. Of the Democratic majority, however, only Commissioner Olds and new Vice-Chairman Richard Sachse are regarded as "liberals" by political observers, who rate Commissioner Harrington Wimberley as a conservative Democrat. Commissioner Claude L Draper, Wyoming Republican, is second minority member.

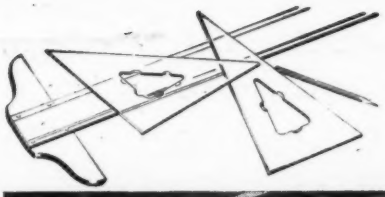
TERM EXPIRES IN JUNE 1950

A graduate and former member of the faculties of Dartmouth College and University of Michigan, Chairman Smith was appointed to FPC in 1943. He served for eight years as a member, then as chairman of New Hampshire Public Service Commission. In 1939 he was elected president of National Association of Railroad and Utilities Commissioners. In 1941 the late President Roosevelt appointed him chairman of Board of Investigation and Research, a post he left to become a member of FPC. His present term of office expires in June 1950.

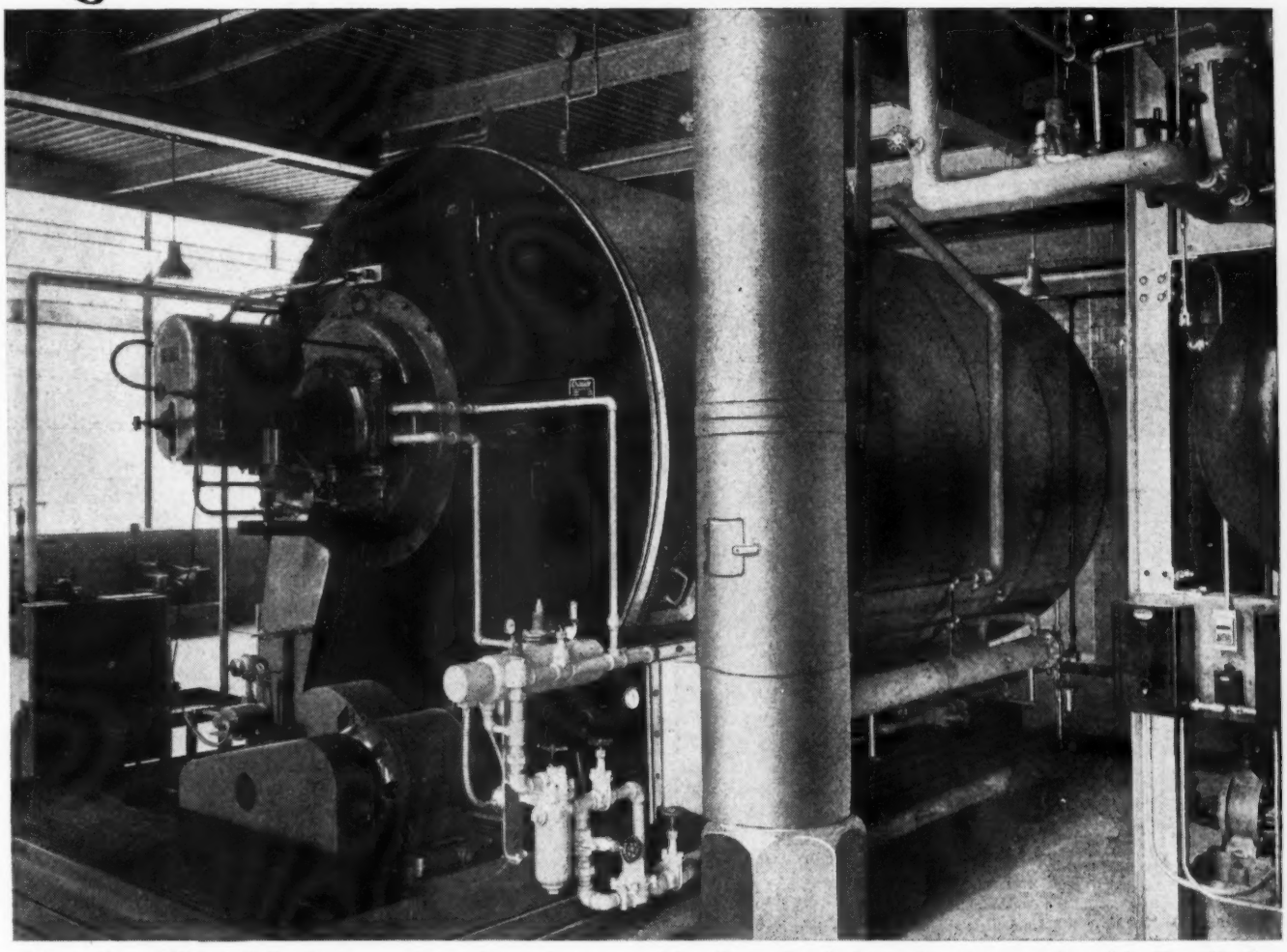
As a commissioner he occasionally dissented from the opinions of the majority of FPC on cases involving rate schedules for public power projects. A notable example was his minority opinion opposing the present Bonneville Power Administration rate base, which, he contended, contained overcharges for navigational development.

Olds, who will continue as a member of the Commission, has twice been its chairman. First appointed to FPC in 1939, he was elected chairman in Jan 1940. He resigned that position in June 1944 and was succeeded by Basil Manly. Upon the latter's resignation in Oct 1945, Olds served as acting chairman until the following Dec, when he again was elected to head the regulatory body. He will complete his present term as a member of the commission in June 1949.

Commissioner Sachse, who was elected vice-chairman, is a native of California. After serving eleven years as chief engineer for the state's Railroad Commission (no Public Utilities Commission) he became a member and president of that panel. He was appointed to FPC in 1945 to fill the vacancy created by Commmissioner John W Scott's resignation. His term expires in June 1947.



PLAN NOW TO CUT YOUR STEAM COSTS . . .



Gain a Clean, Efficient Boiler Room . . . Lower Steam Costs . . . with a Cleaver Brooks Steam Generator . . . planned for Your Needs

Lower Steam Generating Costs Lead To Lower Production Costs . . .

CLEAVER-BROOKS Steam Generators are "tailored" for their job. They are installed to meet an individual plant's needs; Cleaver-Brooks puts unit into initial operation, instructs as to operation, care, and maintenance.

No recommendations are made until sufficient facts and figures have been compiled and a careful analysis completed of your steam requirements on the basis of today's load and tomorrow's anticipated need.

With this information, the most economically sized steam generator and related equipment to handle the load is then determined.

Application engineering, plus basically sound design and construction means that the maximum of value is provided from the day your Cleaver-Brooks Steam Generator is installed.

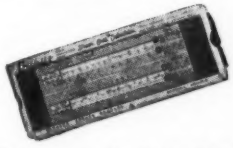
CLEAVER-BROOKS COMPANY, 332 E. Keefe Avenue, Milwaukee 12, Wisconsin

Self-Contained and "packaged"—

Delivery consists of a "packaged" unit. Connections to service outlets are all that is needed. No smokestack is used — a simple vent carries away all products of combustion. No extra foundation is required. Compact—the unit fits into limited space and low headroom locations. Sizes: 22 models — 15 to 500 hp; pressures 15 to 200 lbs. p.s.i.

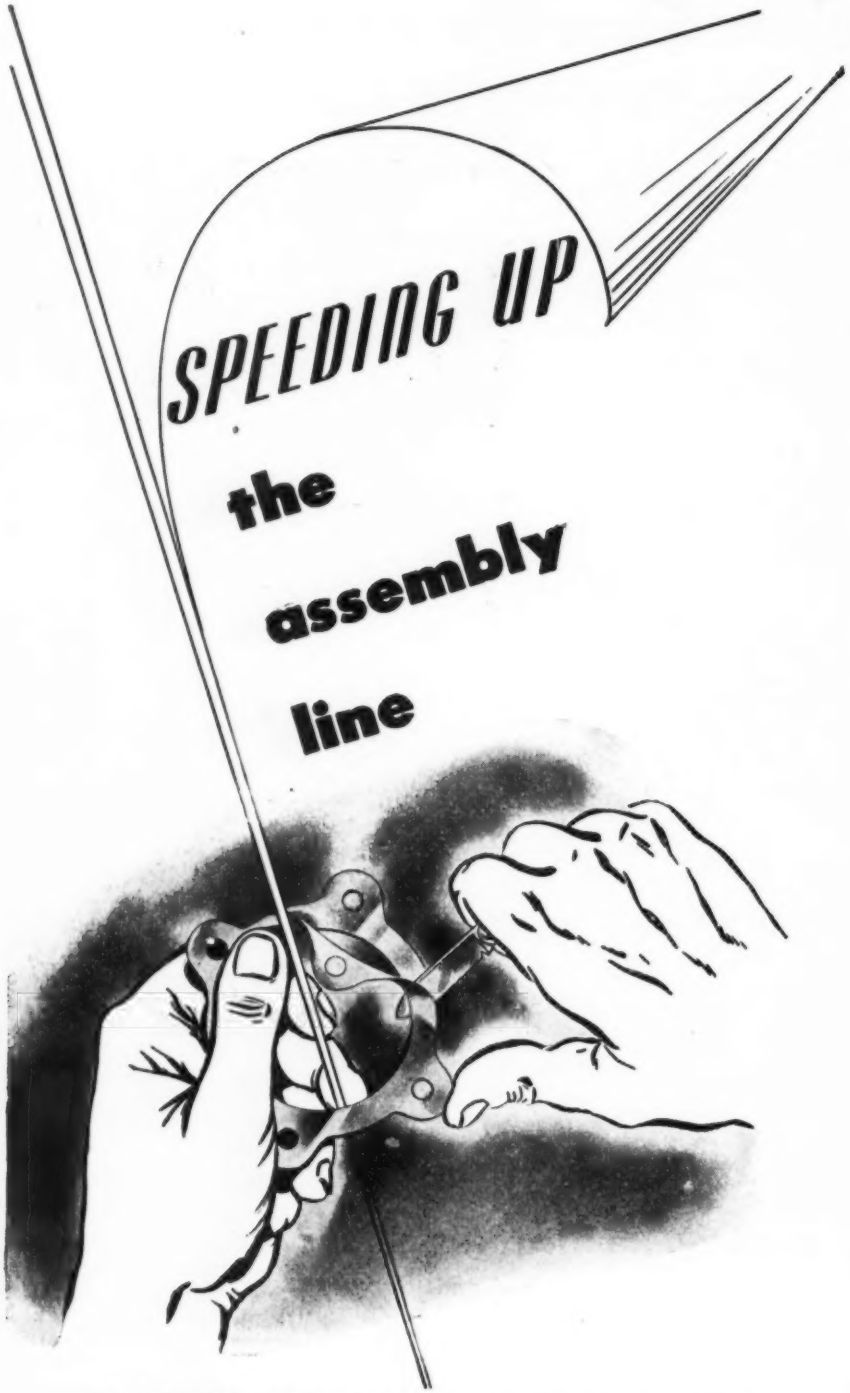
Money-making performance—

The Cleaver-Brooks Steam Generator is designed for easy operation and low upkeep cost. Operation is at 80% efficiency from full load down to 30% of its rating. The high heat transfer from the 4-pass, down-draft boiler produces fast steaming. A boiler room as clean as the home or office is possible through use of oil for fuel.



WRITE on your business letterhead for the Free Steam Cost-Calculator —a ready-reference slide rule showing the comparative steam costs when using oil or coal as fuel.

Cleaver-Brooks
STEAM GENERATORS



IN SPEEDING UP the fitting of machine parts by eliminating the precision machining otherwise required, Laminum shims actually add to the certainty of uniform accuracy . . . you simply peel laminations of known precision gauge from the solid shim. Bulletin on request.

Laminum shims are cut to your specifications. For maintenance work, however, shim materials are sold through industrial distributors.

Laminated Shim Company, Incorporated
61 Union Street • Glenbrook, Conn.

LAMINUM
THE SOLID SHIM THAT peels FOR ADJUSTMENT

2217

Bituminous Coal Agency Approves Research Budget

Board of directors of Bituminous Coal Research, Inc, national research agency of the industry, approved a budget of $447,200 for its general program of cooperative research and development projects to be carried on during 1947. This is in addition to large expenditures planned in 1947 for coal-burning gas-turbine locomotive research and development by the BCR Locomotive Development Committee. Funds were made possible by voluntary contributions from coal companies and associations, coal-carrying railroads and coal-burning equipment manufacturers.

As in 1946, this year's BCR program will be an expansion as well as a continuation of development work earlier. In 1947, Dr Harold J Rose, vice-president and director of research, Bituminous Coal Research, Inc, stated BCR projects will include six on railroad locomotive utilization of coal, 15 on residential uses, eight on industrial steam and nonsteam uses, and two on mining and preparation.

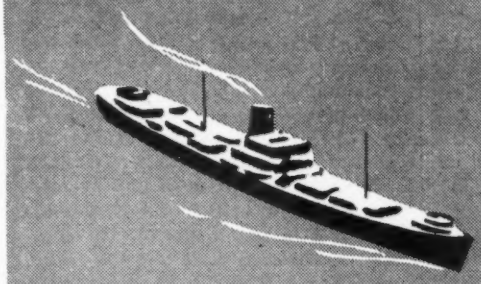
The industrial steam and nonsteam uses to be studied by BCR—also to be handled at Battelle—include overfire air for fuel beds, stoker and boiler-furnace designs and gasification of pulverized coal. Another project relates to flow of mixtures of pulverized coal and air, including metering. Studies of drying of coal fines will be continued.

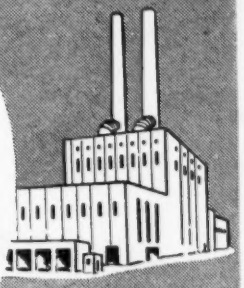
Coal output lost during the strike will mean a shortage all winter, *Business Week* declares in its weekly "Outlook." The miners are back on the job, presumably at least until Apr 1. Through the cold months, however, we shall consume more coal than we mine. The best that most industries can expect is to squeeze by on a hand-to-mouth basis until stocks begin to grow next spring and summer. If the miners walk out again in April, there's no telling when we shall be able to catch up. Coal, along with a lot of other things, is going to cost more as a result of freight-rate increase granted railroads.

Thermoid Co is constructing a new manufacturing plant at Nephi, Utah. To be know as Thermoid Western Co, the Nephi plant has been undertaken to supply West Coast and Northwestern business of Thermoid. For the most part, manufacturing will be directed toward production of rubber products, such as belting. Also to be produced at the plant are such wrapped-hose products as rotary hose, stuffing-box rings, suction hose and air and vacuum hose. Molded hose products will include air, water and steam hose, wire hydraulic molded hose and woven-radiator hose.

J M Storey, who has just returned to England from an extended trip in the U. S. where he visited a number of leading manufacturing plants, was elected chairman of British Valve Manufacturers' Association at the seventh annual general meeting held on Nov 20 at Grosvenor House, London. Mr Storey is managing director of Dewrance & Co, Ltd.

WIZARD CONDENSER INJECTOR

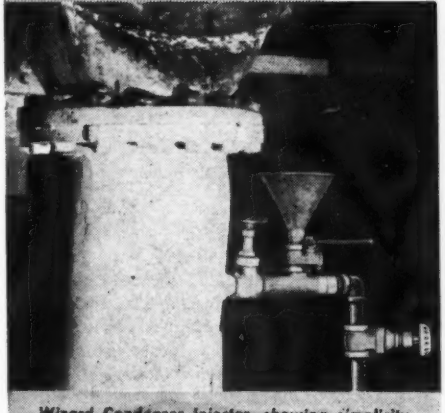




For marine or stationary plants

CONSECO

Positive protection against untimely condenser shutdown



Wizard Condenser Injector, showing simplicity of installation in condenser circulating water line between circulating pump and condenser.

The Wizard Condenser Injector offers a simple, inexpensive positive means of stopping tube leaks instantly while the unit continues to operate. Defective tubes can be plugged or replaced at the next regular servicing.

The injector is installed as shown in the picture. When a leak occurs the unit injects an inexpensive, harmless dry sealing compound into the circulating water, and stops the leak instantly. The injector will give a lifetime of trouble-free service.

Your condenser tubes are bound to leak sooner or later — probably at some inopportune time. Even a brand new condenser or one just retubed can start leaking. Get permanent protection at insignificant cost with a Wizard Condenser Injector. Send for new bulletin.

SERVICE — *A highly skilled, specially equipped service organization, ready for immediate action anywhere on the continent, backed by engineering and manufacturing facilities producing over 3,000,000 sq. ft. of heat exchangers annually.*

CONDENSER SERVICE & ENGINEERING CO., INC.

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Industrial ad Oil Refinery Heat Exchangers
And other types of heat exchange equipment

"MEGGER"*
INSULATION TESTER

IT'S VERSATILE—Used for detecting and diagnosing trouble in nearly all types of electrical equipment including: motors, generators, transformers, switchboards, appliances, lighting circuits, meters and relays . . . practically *everything* electrical.

IT'S EASY TO OPERATE—Simply make connections, turn the crank and take a direct reading. It's as simple to read as a voltmeter. Ratings up to 50 megohms, 500 volts.

IT'S CONVENIENT—Requires no external power supply, no adjustments, no batteries or replacement parts. DC test current is supplied by a self-contained hand-operated generator—an unfailing source, *always* ready for use.

IT'S INSURANCE—Insulation testing with a "Megger" Tester is your first line of defense in electrical preventative maintenance . . . your protection against moisture and other enemies of electrical insulation . . . a *must* in your struggle for uninterrupted electrical service.

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READ THIS BULLETIN . . . Here's the ABC of the Midget "Megger" Insulation Tester, telling briefly and in common sense language just what the Midget "Megger" Tester is, how it is used . . . AND . . . what it will do for you. Write for your copy of Bulletin 1785 -P *today.*

James G. **BIDDLE CO.**

ELECTRICAL & SCIENTIFIC INSTRUMENTS

1316 ARCH STREET • PHILADELPHIA 7, PENNA.

Transmission Line's Faults Located

NATIONAL RESEARCH COUNCIL of the Heat Laboratory, Canada, successfully located faulty joints by heat which they radiated, in transmission lines at Shawinigan Falls, Quebec.

Operating on the principle that bad joints heat up because of increased resistance the National Research Council decided to detect hot joints by infrared rays. This method is similar to infrared detection employed by the armed forces for locating at a distance hot bodies such as ship funnels.

To make the test two bolometers, or heat detectors, were tried in the lines of the Shawinigan Power Co. One heat detector, developed by C D Niven and C St. Jacques, depends on the variation in resistance of a thin film of washed Cellophane when under the influence of heat. The second bolometer, captured from the Germans, was used for detecting ships off the coast in the dark, and operates from the variation with heat of the resistance of an antimony film.

The bolometer is placed in the focus of a 10-in. front-silvered paraboloid mirror. This focuses the heat from the joint on the bolometer's sensitive element. If the joint temperature is considerably higher than the temperature of the background sky, resistance of the element changes when radiation from the joint falls on the element. A galvanometer amplifies this change and a needle registers the swing.

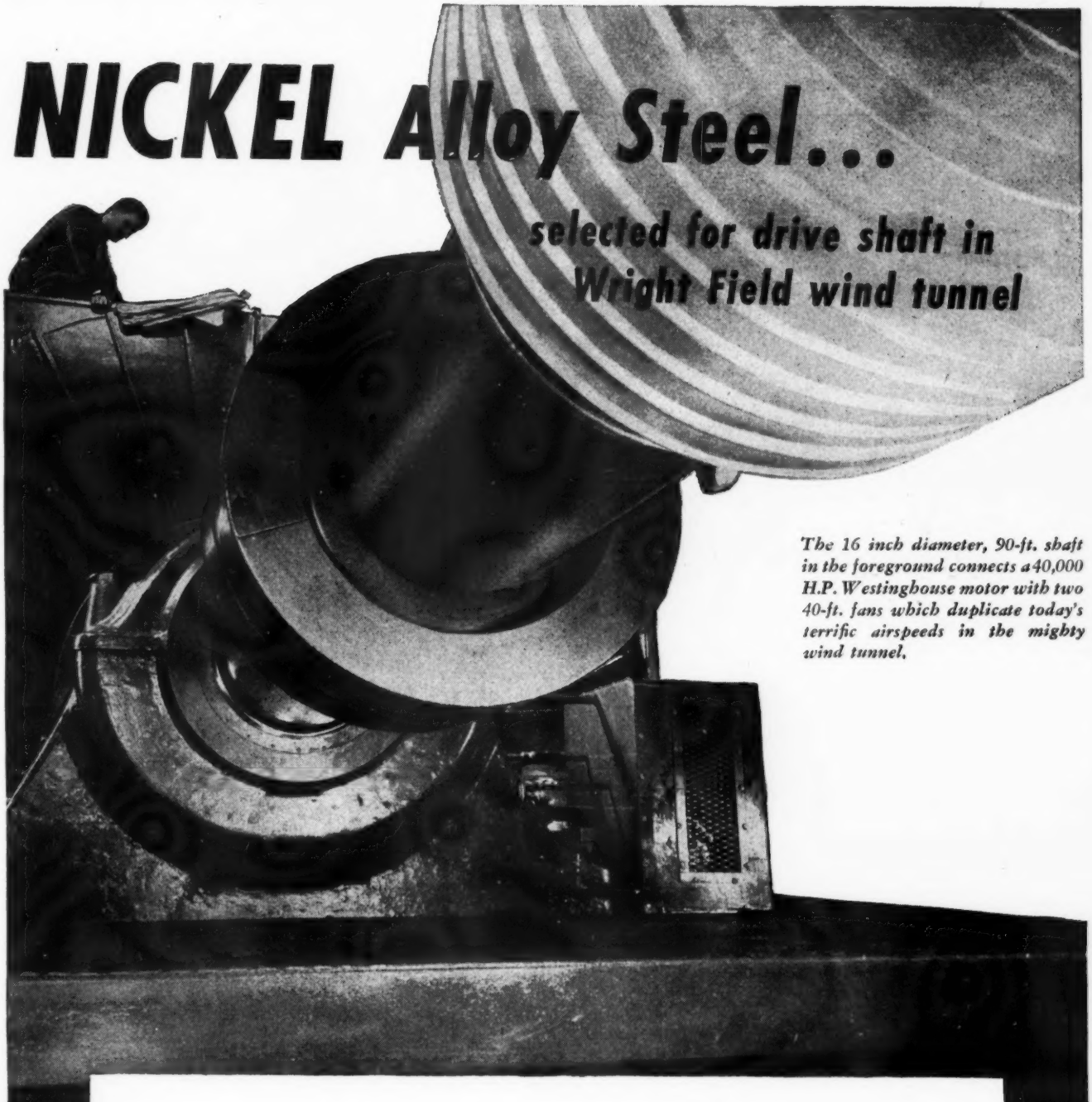
At Shawinigan Falls both detector sets worked well. Two of ten joints tested showed marked heating with an estimated temperature of 300 and 400 F, respectively. A little heat was detected in cables of an ordinarily well-loaded transmission line. A good joint on such a line showed cooler than the cable. An insulator near a carbide plant indicated heat whereas a knife switch showed none.

Monsanto Chemical Co announces construction of a $3,000,000 plant in Monsanto, Ill., to expand production of "soapless soaps." The company said the plant, a one-story concrete building already under construction, would be in operation in 1947. The Monsanto plant at Nitro, W. Va., is being enlarged to increase production of these soaps, which are sold under the name *Santomerse.*

The 100th anniversary of birth of Thomas A Edison will be observed on Feb 11, 1947. He is considered by many people to be America's greatest inventor. His first patented invention was the electrical vote recorder. Other inventions include the stock ticker; motograph; telegraph systems; paraffin paper; carbon rheostat; mimeograph; carbon telephone transmitter; phonograph; incandescent electric lamp; radical improvements in construction of dynamos; systems of distribution, regulation and measurement of electric current, including sockets, switches, fuses; magnetic ore separator; indicator using the *Edison Effect,* which was the first application in field of electronics; motion-picture camera; fluoroscope, etc.

NICKEL Alloy Steel...

selected for drive shaft in Wright Field wind tunnel



The 16 inch diameter, 90-ft. shaft in the foreground connects a 40,000 H.P. Westinghouse motor with two 40-ft. fans which duplicate today's terrific airspeeds in the mighty wind tunnel.

The high mechanical properties required for this large drive shaft were specified by Westinghouse Electric Co., Inc., suppliers of the wind tunnel motor and auxiliary equipment.

To meet the specifications, a Nickel-molybdenum steel was selected.

Significant are test results on bars from prolongations of the forgings, after normalizing and tempering:—

Ultimate tensile strength	117,500 p.s.i.
Yield Point	90,500 p.s.i.
Elongation in 2"	20.0 %
Reduction in Area	55.4 %

We invite inquiries on the uses and selection of Nickel alloy steels, and other Nickel alloys.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

NEW SAFETY IN GASKETS

"Flexitallic" GASKETS
How Flexitallic Precision Brings a New Degree of Safety
for sealing steam and other fluids under pressure
FLEXITALLIC
8th & Bailey Sts.

WILL YOU READ ABOUT IT?

This new little book speaks of safe-sealing for fluids under pressure with the plain honesty the subject of safety deserves.

It tells with sketches and few words how the "Flexitallic" art which established itself in wide use through safe performance has now put safety on a new level.

You are not asked to abandon one theory and accept another. The book deals with a record of performance and identifies the practices that make the record possible. You are urged to believe only what pre-testing can—and will—prove to you.

We'll send you a copy

A post-card will serve but you will help us in record-keeping by giving us the name of your company and your title or department.

Originators of Spiral-Wound Gasket Construction

"Flexitallic"

Gaskets of this name are manufactured only by

FLEXITALLIC GASKET COMPANY
8th and Bailey Streets Camden, N. J.

FOREIGN POWER FIELD

STOCKHOLM *(McGraw-Hill World News):* Since 1939 output of water-generated power in Sweden has increased from 9054 to 13,500 million kwhr. The big new plants, Midskog, Jarpstrommen and Gammelange on Indal River, have been taken into use in last few years. Among power works to be completed within next five years, or so, are Harspranget on Lule River, Hjalta, Forsmoforsen and Namforsen on Angerman River and Holleforsen on Indal River. When ready in 1951, the Harspranget plant, of 255,000 kw, situated above Artic Circle, will be Sweden's biggest hydroelectric power station.

A dam structure with a length of 2000 ft has been built at the well lake of Lule River, high up in mountains of Lapland, to regulate water supply to this plant. By means of the Suorva Dam structure, which has taken more than two decades to construct, size of lake has been heavily increased. At high-water level it covers a surface of about 110 sq mi and maximum storage capacity is 113,000 million cu ft.

Undoubtedly Sweden will have a good deal of interest to show foreign water-power men as dam builders and hydroelectric experts from all parts of the world will meet at a big international congress in Stockholm in June 1948. The Swedish invitation was issued at the recent Dam Builder Conference in Paris. On the same occasion an executive committee was elected for reorganizing conference activities in this field, with a Frenchman, M Coyne, as chairman, and a Swede, G Westerberg, chief engineer of Swedish Board of Waterfalls, as one of the vice-chairman.

LONDON *(McGraw-Hill World News):* Spare parts for Deutz diesel engines which were, before the late war, widely recognized as a leading German design, are now to be made available throughout the world by British Deutz Ltd, London, as result of an arrangement recently concluded with former British agent of the German manufacturer. Considerable stocks of Deutz engine spares have been accumulated already and more are being manufactured that conform exactly to dimensions and material specifications of original Deutz drawings. In addition, factory overhaul of major components is provided. Similar stocks of parts and service facilities are offered in every country of the world through agents of British Oil Engines (Export) Ltd, an associated company. Eventually, when supply of materials permits, the company contemplates manufacture of complete Deutz engines in several sizes.

LLANELLY, WALES *(McGraw-Hill World News):* Llanelly and District Electric Supply Co, Ltd has announced that they are to build a $48,000,000 power station at Burry Port in accordance with an agreement recently entered into with the Central Electricity Board. The undertaking will be one of largest of its kind in British Isles. Power station is designed for an ultimate capacity of 300,000 kw and is to be constructed in sections. The first

(Continued on page 172)

THE DOCTOR SAYS IT'S

"Industrial Arteriosclerosis"

What the Doctor means, of course, is "thickening of the walls of the arteries"—the rust-clogging of those all-important industrial pipelines that convey water, compressed air, gases, fuel oil, refrigerants, lubricants, and an almost endless variety of process materials in fluid form.

Symptoms may be evident in reduced volume of flow, inadequate pressure, increased pumping costs, or rust-stained solutions.

Surface coatings of any kind offer but temporary protection and, eventually, rust-roughened pipe interiors will accelerate "sliming-up," particularly in lines with threaded fittings. The result may be a product contaminated by flaked-off scale, non-seating valves, clogged indicating or recording instruments, untimely dismantling for cleaning, or premature pipe replacement.

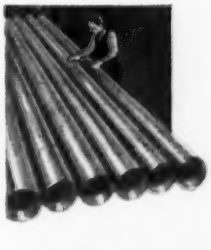
Copper tubes are not a panacea for all industrial piping ills—but they go a long, long way toward a permanent cure. Just how and why are explained on the following page.

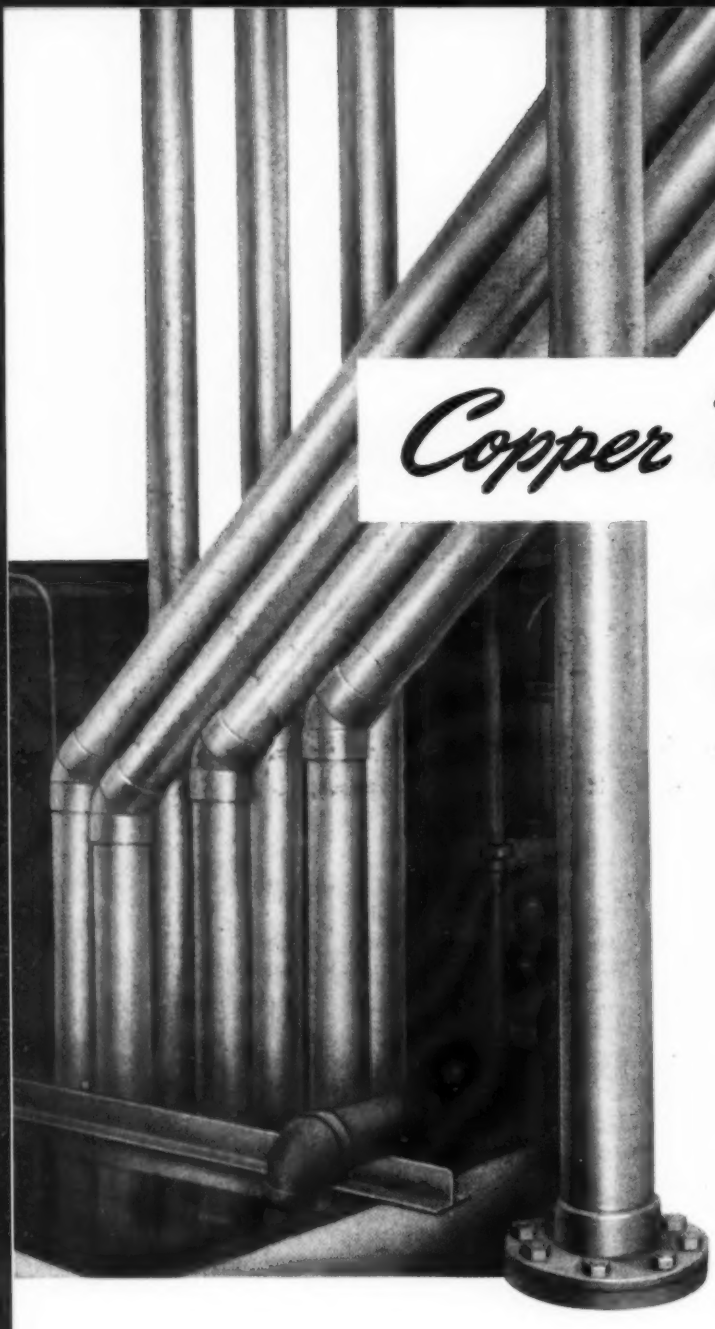
THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

ANACONDA
from mine to consumer

Anaconda **COPPER TUBES AND FITTINGS**

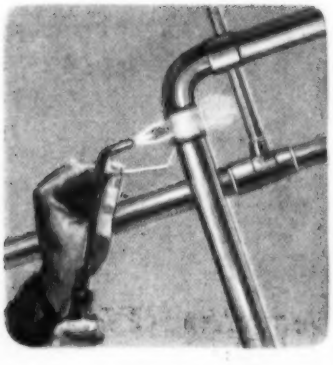




Copper Tube Pipelines?

COMPARE THEM—point for point with any material . . . at any price

- Copper tubes combine the advantages of corrosion resistance, light weight, flexibility and low installation costs.
- Pipelines of copper tubes connected with solder fittings can be taken down, moved, or have new connections cut in faster and with less expense than with threaded pipe.
- Bends and offsets to clear beams, girders or other obstructions can be made readily in copper tubes.
- Assembled with solder fittings, such lines have a low coefficient of friction and reduced resistance to flow . . . no need for oversize lines to provide for clogging.
- Anaconda Solder Type Fittings can be installed in restricted space where the use of a wrench would be impossible.
- Anaconda Copper Tubes in standard sizes are furnished to A.S.T.M. and Federal Specifications: Soft in 60-ft. coils; also hard and soft in 20-ft. straight lengths from ⅜″ to 12″ in diameter. Larger sizes, up to 26″ I.D., can be made to order.



Publication C-24 tells a lot more about Anaconda Copper Tubes and Fittings. A copy will be mailed on request.

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

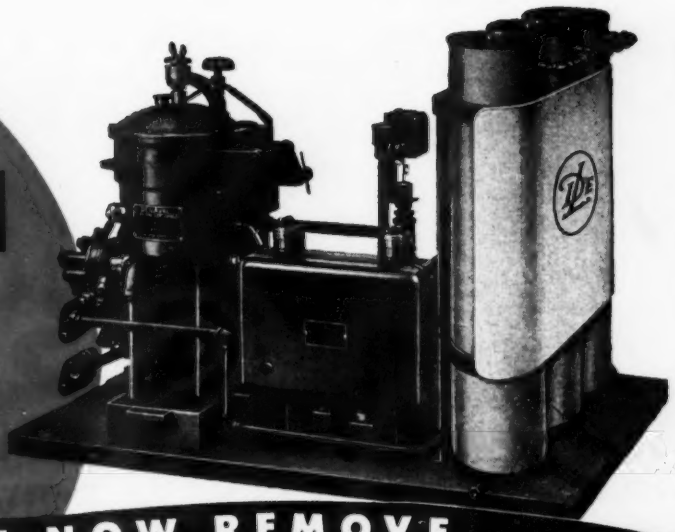
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

46162

ANACONDA
from mine to consumer

Anaconda COPPER TUBES and FITTINGS

Centrifugal PURIFICATION *PLUS* Micronic FILTRATION



YOU CAN NOW REMOVE

DIRT-CARBON-WATER

FROM DIESEL LUBE OIL!

Note these Features

1. Removes dirt and water by centrifugal force
2. Filters out harmful carbon
3. Does not remove valuable additives
4. Cleans oil at moderate temperature
5. Speeds up inspection—crankcase is cleaner
6. Minimizes ring sticking
7. Increases bearing life
8. Saves labor—long runs without bowl cleaning
9. Increases oil life
10. No dirt . . . carbon . . . or water

THE De Laval "Puri-Filter" enables the Diesel operator to purify Diesel lubricating oil by a combination of centrifugal force and positive filtration. It combines the De Laval "Uni-Matic" Oil Purifier which centrifugally removes most solid impurities and all water, and Fram "Filcron" Filters which, in cleaning the Diesel lubricating oil, also restore the oil to a translucent amber color. The De Laval "Puri-Filter" leaves the lubricating oil ***clean*** and ***dry*** . . . provides the ***maximum*** in protection for every engine.

The De Laval "Puri-Filter" is complete with dirty-oil and clean-oil pumps, and is piped, ready to operate. Electrical controls are provided and all parts are mounted on a metal base.

For additional details, ask for Bulletin DL-1.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
PETERBOROUGH
QUEBEC MONTREAL WINNIPEG VANCOUVER

DE LAVAL OIL PURIFIERS

FOR DIESEL LUBRICATING OIL

MURRAY

TYPE S

SINGLE STAGE TURBINES
FOR MECHANICAL DRIVE

Murray Type S single turbines for mechanical drive have horizontally split casing with steam and exhaust connections in lower half. Two-row impulse type stainless steel blading. Completely enclosed constant speed governor and emergency overspeed governor. Carbon ring glands. The unit is compact with the ruggedness expected on this type drive. Suitable for driving centrifugal pumps, fans, blowers, and small generators.

Write today for Murray Bulletin 121—it illustrates and describes in detail Murray Type S Turbines.

MURRAY *also produces:*
Turbine Generators up to 3,000 KW rating.
Vertical Steam Turbines, both direct connected and geared.
High speed reduction gears.
Steam Boilers.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA
Builders of Steam Power Equipment for Three Quarters of a Century

section, which will cost $20,000,000, is scheduled for commercial operation by end of 1950. It is estimated that the whole undertaking will take nearly ten years to complete.

BERLIN *(McGraw-Hill World News):* According to reports seeping out of British Zone of occupied Germany, a new scientific research organization, known as Max Planck Society, has been founded in Goettingen under presidency of atom-smasher Prof Otto Hahn. He is scheduled to leave for Stockholm this month to receive Nobel Prize in chemistry, awarded in 1944 for his epoch-making fission of uranium atom—discovery of which laid groundwork for subsequent invention of atom bomb.

Replacing on a small scale the Kaiser Wilhelm Society for Promotion of Science, dissolved last August by quadripartite agreement of the Allied Control Authority, this new society will probably contain an institute for nuclear research under supervision of physicist Heisenberg. Although work of famous Goettingen Aerodynamics Institute has been discontinued, Kaiser Wilhelm Institute for current research (Stroemungsforschung), with which it was intimately associated both before and during the war, as well as Gmelin Institute (famous for its still unfinished 50-volume chemistry manual) located in the nearby Harz Mountains, may also become a part of the new organization.

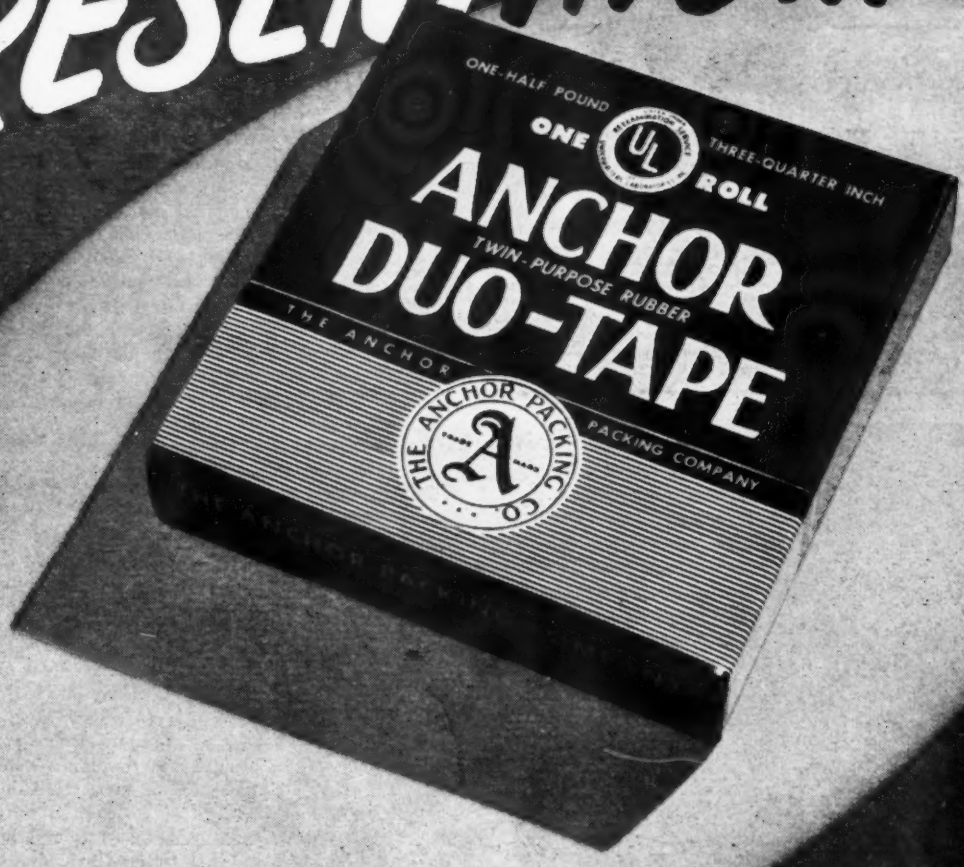
SCOTLAND: North of Scotland Hydro-Electric Board has placed contracts for nearly $15,000,000 on Loch Sloy hydroelectric project. This development consists of (1) a concrete dam, 1160 ft long with a maximum height of 165 ft (2) a horseshoe-shaped tunnel, 9000 ft long; 15 ft, 4 in. wide inside its concrete lining (3) a concrete-lined surge chamber, 273 ft high by 26 ft diameter, cut in solid rock (4) two electrically welded penstocks, 10 ft diameter, 642 ft long, that branch to four lines, 7 ft diameter, nearly 7000 ft long (5) four 900-ft head vertical-shaft francis turbines driving 32,500-kw generators.

MOSCOW *(McGraw-Hill World News)*—Nizhen-Svir hydroelectric station near Leningrad has put back into operation a 24,000-kw turbine. This makes the second of the four original turbines to be restored to operation.

NEW DELHI, INDIA *(McGraw-Hill World News):* Engineers in charge of planning the Damodar Valley multipurpose hydro project have abandoned plans for construction of a 5 mile long, 100 ft high, hydraulic-fill dam at Sonalpur after bitter protests from coal-mining interests that it would result in flooding of large coal deposits. A new site is being surveyed farther down the Damodar. Planning of Maithon and Aiyar Dams is going ahead, however, as it has been definitely established that their reservoirs will not affect any coal deposits.

NEW DELHI, INDIA *(McGraw-Hill World News):* Indore State, in Central India, is conducting intensive studies of Chambal River gorge in Bhanpura district preparatory to starting work on a hydroelectric project, which will create a reservoir larger

PRESENTING...



THE spotlight is now on a new product, ANCHOR DUO-TAPE. This newest addition to the famous ANCHOR line of reliable products is a "twin-purpose" rubber tape that doesn't ravel or unwind. ANCHOR DUO-TAPE does double duty in many applications.

When your house or plant was wired the electrician had to use two kinds of tape . . . ordinary friction tape and splicing compound. The wiring would not have passed inspection without BOTH! With friction tape only . . . the wiring wasn't safe. Every joint had to be wrapped twice.

Not so when ANCHOR DUO-TAPE is used. Just one wrapping of Anchor tape provides insulation for lines carrying up to 220 volts; a double wrapping insulates lines carrying 650 volts. It is a high voltage product approved for not less than 300 volts per. 001" thickness in accordance with ASTM Standards No. D119.

With ANCHOR DUO-TAPE, wire or cable splices can be given a waterproof Underwriters' approved seal in less than half the time required when both friction tape and splicing compound are used.

ANCHOR DUO-TAPE is made of a high quality cotton fabric impregnated with an adhesive compound that is inseparably bonded to a special uncured rubber stock.

ANCHOR DUO-TAPE won't dry out and come loose as friction tape does. Be sure to include a request for ANCHOR DUO-TAPE when you place your next order for ANCHOR PACKING products.

THE *NEW* MULTI-PURPOSE TAPE

Ideal for insulating both inside and outside wiring and in the maintenance and repairing of motors, generators, transformers and similar equipment; repairing rubber hose and tubing, lamp cords, etc. ANCHOR DUO-TAPE has many miscellaneous uses around the plant, shop or home. It provides better protection against short circuits and blown fuses. You'll never realize how many uses ANCHOR DUO-TAPE has until you try it out.

THE ANCHOR PACKING CO. TRADE MARK

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

BRANCH OFFICES

Baltimore, Maryland . . . Boston, Massachusetts . . . Buffalo, New York . . . Cleveland, Ohio . . . Columbus, Ohio . . . Chicago, Illinois
Cincinnati, Ohio . . . Detroit, Michigan . . . Houston, Texas . . . Indianapolis, Indiana . . . Kansas City, Missouri . . . Los Angeles, California

THE PACKING for EVERY PURPOSE

Stop Leaks Prevents Scoring

ALLPAX

This universal packing—consisting of long, tough fibrous asbestos fibres, thin flakes of anti-friction metal, minute graphic scales and a heat-proof lubricant — is recommended for general service against steam, water, air, ammonia, oils, gases, etc., where temperatures do not exceed 600°F. Fits all sizes and shapes of stuffing boxes. Special styles available for high temperature and corrosive liquids, for products, etc. Try it and you'll use it regularly.

Distributors everywhere

THE ALLPAX CO., INC., MAMARONECK, N. Y.

Gauge Glasses TESTED *for Pressure*

One way to get trouble-free service out of your Gauge Glasses is to select the right glass for your particular service. For instance if you use the pressure table as a guide, you can be sure your Gauge Glasses will stand up in service. Actual routine tests prove that Pyrex and Corning Gauge Glasses will withstand pressures in excess of those recommended.

Machine drawn accuracy permits ease of installation and minimizes breakage. Resistant to the solvent action of hot water and steam, the hard, smooth surface of the glass also resists abrasion. These are some of the important features that add to the life and economy of Pyrex and Corning Gauge Glasses. Corning Glass Works, Corning, New York.

"PYREX" and "CORNING" are registered trade-marks and indicate manufacture by Corning Glass Works, Corning, N. Y.

CORNING Glass Works Corning, New York

Pyrex Gauge Glasses BRAND

than any existing in India now. Current plans call for construction of a dam across end of the gorge, which is three miles in length, has sides more than 300 ft high and narrows down from 3000 ft at its mouth to 600 ft at its foot. A dam across the foot, 150-175 ft high, would store nearly 3,500,000 acre-ft of water drained from a catchment area of 8500 sq. mi.

Rain falls in the area only during the 4-month monsoon season, but varies between 16 and 60 in. annually with the average estimated at 42 in. Records of flood years indicated the dam would need a discharge capacity of 500,000 to 600,000 cfs. Unfortunately there is no natural waterfall in the river at this point, but it is felt that height of the dam itself would be sufficient for power generation.

NAGATAC, COSTA RICA *(McGraw-Hill World News):* Costa Rican government approves construction of a new hydroelectric power plant at Nagatac on Barranca River. Agreement for construction was made with Compania Electrica de Puntatrenas, an American-controlled company. The first generating unit, capacity of 1800 kw, must be completed within two years.

MEXICO: Arrangements have been completed for U. S. Navy Dept to lease to Mexico a 10,000-kw Navy power train to alleviate power-shortage conditions due to an extreme drought south of border. It was hooked onto Guanojuato power system of American & Foreign Power at Celaya, Mexico, this month. Present plans are that train will remain on lease to Mexico until Feb 1, 1948, by which time additional generating capacity is to be installed on system.

Five American Navy officers are being sent to Mexico with the power train to supervise its operation. In all, around-the-clock operation of the train requires about 40 workers.

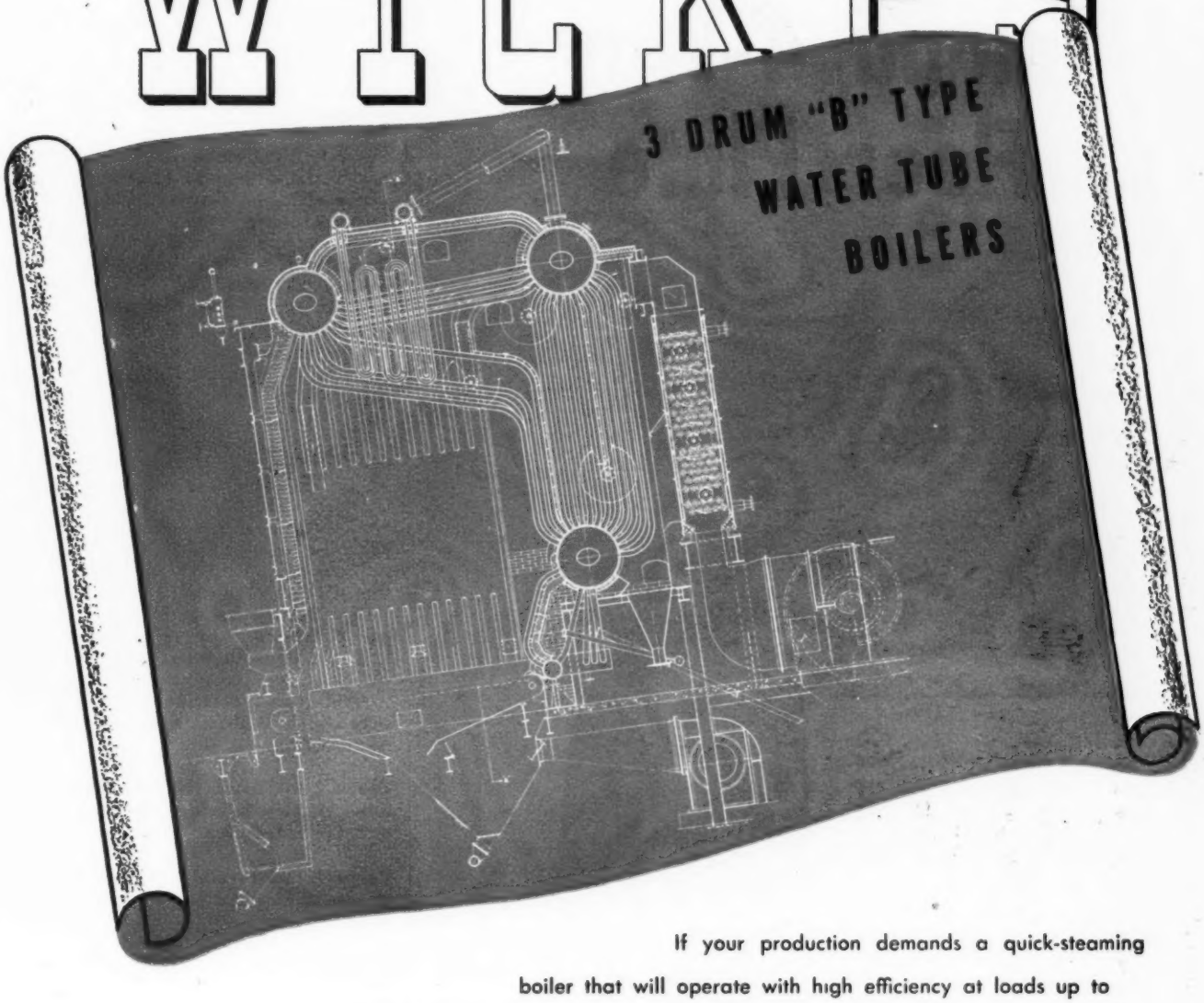
Negotiations for lease of power train to Mexico were conducted through State Dept by staff of American power consultants headed by Edward Falck, former director of wartime Office of War Utilities, which was retained by Mexican government last fall to advise it on both short-term and long-term power planning in that country. (See POWER, Nov 1946, p 148.)

SHANGHAI *(McGraw-Hill World News):* Two 1000-kw generators, built for rehabilitation of Holland, are on their way to Shanghai. Early in 1947 they will be installed at Sung Sing Cotton Mill No. 4, Hankow.

Anticipating that the war would leave many of the country's power sources in ruins, the Dutch ordered the generators from Westinghouse. This ruination did not occur and the Dutch asked Westinghouse to sell the generators. Three have been shipped from Holland to South America, and two are scheduled to arrive in Shanghai any day now. William Hunt & Co handled the Shanghai end of the transaction.

Before installation of generators the Sung Sing plant will be converted from oil to coal. It is more economical to use coal as the plant is close to coal mines, which lie along railroads coming into Hankow.

WICKES



If your production demands a quick-steaming boiler that will operate with high efficiency at loads up to 250,000 lb. per hour, it will pay you to investigate Wickes 3-Drum Water Tube Boilers. Wickes Boilers have rapid and unrestricted water circulation; properly baffled passages for products of combustion; long drums with fusion welded seams; tubes bent to easy radius and arranged for more effective absorption of radiated furnace heat; and 100% adaptability to any type of firing equipment. Entire installation easily accessible for inspection and maintenance. Send us your power problems and our engineers will help you determine whether a Wickes 3-Drum or other type of Wickes boiler will effect greater power efficiency and economy in your plant.

THE WICKES BOILER CO.
SAGINAW, MICHIGAN, EST. 1854

SALES OFFICES: Detroit; Chicago; New York; Milwaukee; Pittsburgh; San Jose; Tulsa; Fort Worth; Mexico City; Saginaw; Boston; Indianapolis; San Francisco; Buenos Aires; Seattle; Los Angeles; Atlanta; Charlotte; Denver; Jacksonville.

This is

Inland 4-Way Floor Plate

Yes, this is Inland 4-Way Floor Plate . . . that safe, dependable steel flooring that guards against dangerous slips and falls . . . and lasts for years and years.

For floors, steps, walkways, platforms and elevator hatchways, it provides structural strength and safety. The attractive 4-way pattern cleans easily and drains freely.

If your plant, building or product needs added safety under foot or wheel, you'll want to know more about Inland 4-Way Floor Plate . . . Available for immediate delivery from conveniently located steel warehouse distributors.

SAFE, ECONOMICAL
EASY TO INSTALL
Write for Catalog

INLAND STEEL COMPANY
38 S. Dearborn Street — Chicago 3, Ill.
Sales Offices: Detroit, Indianapolis, Kansas City, Milwaukee, New York, St. Louis, St. Paul

APPOINTMENTS

General Electric's apparatus dept named Richard Cutts Jr assistant manager; E J Boland, manager sales for division's instrument section; and E J Wehrle, consultant of instrument section. Mr Cutts will continue his duties as manager of sales for division's meter section also. D E Craig has been appointed manager sales of unit substation section, unit equipment division.

Frank M Clark, insulation expert at Pittsfield works of **General Electric Co's** apparatus dept and assistant engineer of the works laboratory there, has been made technical consultant on insulation of entire apparatus dept. He will retain his former position at Pittsfield also. Ernest E George has been appointed engineer of metallurgy div of chemical dept. Robert O Bullard becomes engineering and manufacturing manager of metallurgy div of chemical dept; Edgar L Hubbard, sales manager; and John A Beals, div accountant.

Link-Belt Co, Chicago, announce opening of a sales office in Milwaukee, Wis., at 808 N 3rd St. William M Hufnagel, district sales manager, is in charge of the new office, assisted by H B Johnson and F E Sweeney.

Harold S Silver has been named general patent attorney in charge of patent dept, legal div, **Allis-Chalmers Mfg Co,** Milwaukee. He succeeds the late J J Kane. Howard Hansen became supervisor of the office of J L Singleton, who is manager of district offices.

Robins conveyor and Hewitt rubber divisions of **Hewitt-Robins Inc** combined their Chicago offices at 7 S Dearborn St.

Pennsylvania Flexible Metallic Tubing Co elected Eugene J Ronan executive vice-president.

Appointment of John C Campbell as manager of industrial engine sales and James W Brown as advertising manager of Detroit diesel engine div, **General Motors Corp,** was announced.

Reeves Pulley Co established its own Philadelphia office in the Wilford Bldg, 33rd and Arch St. Philip C Talbot has been made manager of this new branch office; he will be assisted by William A McCosh. Philadelphia territory includes eastern half of Pa., most of Del. and Md., and northern tip of Va.

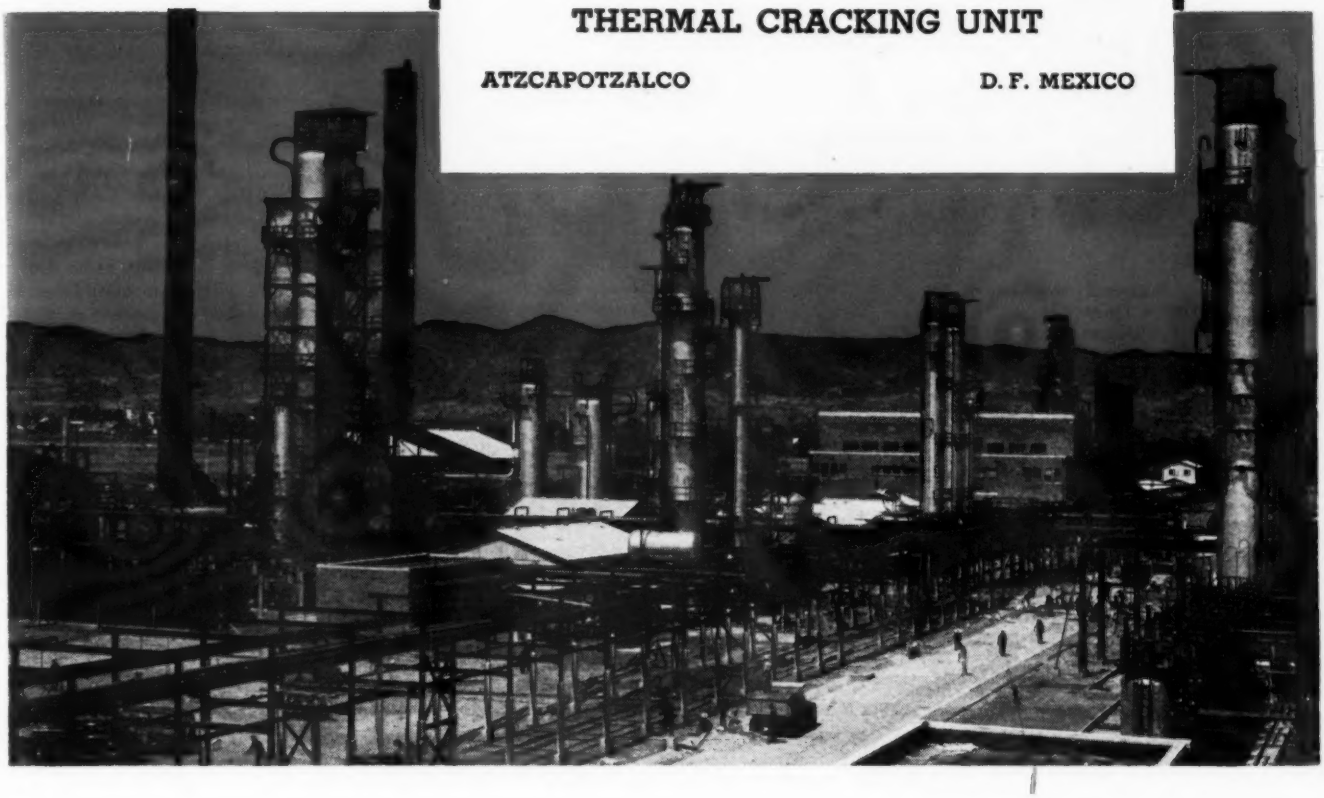
Perfex Corp announces that Julius K Luthe was elected chairman of board of directors. Carroll E Lewis, executive vice-president, was elected president and a director. Allen Butler, vice-president, has taken over responsibilities formerly handled by Lewis in controls div.

John J Healy Jr has been named assistant general manager of Merrimac div, **Monsanto Chemical Co.** L F Loutrel succeeds Healy as director of development dept. Plastics div opened a Cincinnati sales office Jan 1, with Edward T McBride

PETROLEOS MEXICANOS

THERMAL CRACKING UNIT

ATZCAPOTZALCO D. F. MEXICO



THE Benjamin F. Shaw Company furnished pre-fabricated carbon steel and alloy steel piping for this Thermal Cracking Unit, designed and installed by Arthur G. McKee & Co., of Cleveland, Ohio for Petroleos Mexicanos. This job is one of many jobs executed for export to foreign countries. Shaw's dependable piping is known and used round the world.

Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping—any place in the United States and Canada.

Wm. A. Shaw II

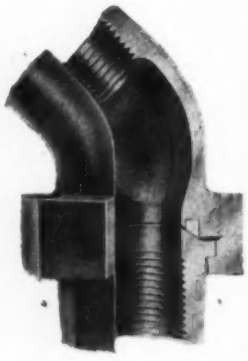
Whatever your piping needs

SHAW

fills them quickly, dependably

Known since 1893 for High-quality, Dependable Pre-Fabrication and Installation

BENJAMIN F. SHAW COMPANY — 2ND & LOMBARD STS., WILMINGTON 99, DEL.



JEFFERSON SPECIALTY UNIONS

provide permanently tight joints . . . made possible by the

RECESSED BRASS SEAT

The Recessed Brass Seat in all Jefferson Unions is made by inserting a seamless brass ring in a recess away from the runway of the fitting. This location, together with the method of insertion and machining, provide in effect a one-piece, permanent, leak-proof construction, the seat being integral with the iron of the fitting itself. Seating surfaces are ground together in pairs assuring a self-seating ball joint which can be made up tight with least possible pressure.

Jefferson Specialty Unions with the Recessed Brass Seat are made in all types for all piping needs. The 45° Union Elbow illustrated is typical of the complete line. Thus it is possible through the use of Jefferson Unions to standardize on unions of utmost dependability.

Consult us or your nearest distributor.

JEFFERSON UNION CO.

601 WEST 26TH STREET, NEW YORK 1, N. Y.

LEXINGTON 73, MASS. LOCKPORT, N. Y.

One Man at One Point

. . . Controls All!

With Beaumont Birch Coal Handling Equipment, one operator controls *all* coal handling with finger-tip controls, like this—

Coal arrives by rail, is dumped into hopper, raised by bucket elevator and discharged either into bunker for immediate use or down a chute to yard storage. If it goes to storage, the Beaumont Drag Scraper spreads it into safe, compact layers—eliminating air pockets.

Use any available space. Tail-blocks can be slung between posts and moved by hand—and mechanically moved on I-beam track, by tail-block car, or suspended from an aerial bridle system. The scraper and cable system is operated by *one* man through remote control. *One* company, Beaumont Birch, supplies all necessary equipment.

Complete engineering service available by writing right now to—

BEAUMONT BIRCH COMPANY

1502 RACE STREET • PHILADELPHIA, PA.

Designers Manufacturers Erectors BULK MATERIAL HANDLING SYSTEM

in charge as branch manager. This office is staffed by Joseph T. Demers and William S Blanchard. Its sales territory embraces parts of Ohio, Ind., Ky., Tenn., Pa., and all of W. Va.

Enterprise Engine & Foundry Co appoints J F McIndoe manager of combustion equipment div.

Louis R Caplan, Washington representative of **Hagan Corp** until he went into the Army, has returned to his post to represent Hagan, Hall Laboratories and Calgon, Inc, interests.

Appointment of Francis J Wakem as vice-president of **Johns-Manville Sales Corp** was announced. He will also continue as merchandise manager of industrial products div.

Chester F Smith, a director of **Standard Oil Co (N. J.)**, has been named a vice-president.

William J Sparks has been made director of chemical div of Esso laboratories, **Standard Oil Development Co of Linden, N. J.** He replaces Per K Frolich, who has resigned.

Stanley C Hope, president of Gilbert & Barker Mfg Co of Springfield, Mass., was elected president of **Stanco Inc** of Linden, N. J. Both companies are affiliates of Standard Oil Co (N. J.). Hope succeeds F W Moss, who had planned to retire at end of this year but has agreed to continue for another year in an advisory capacity on Stanco's foreign marketing activities.

Ampco Metal, Inc, appoints Oscar Frohman general sales engineer. Frohman was manager of market development and will continue to carry out such work as is necessary in that capacity. James Arter has been assigned duties of assistant to general manager.

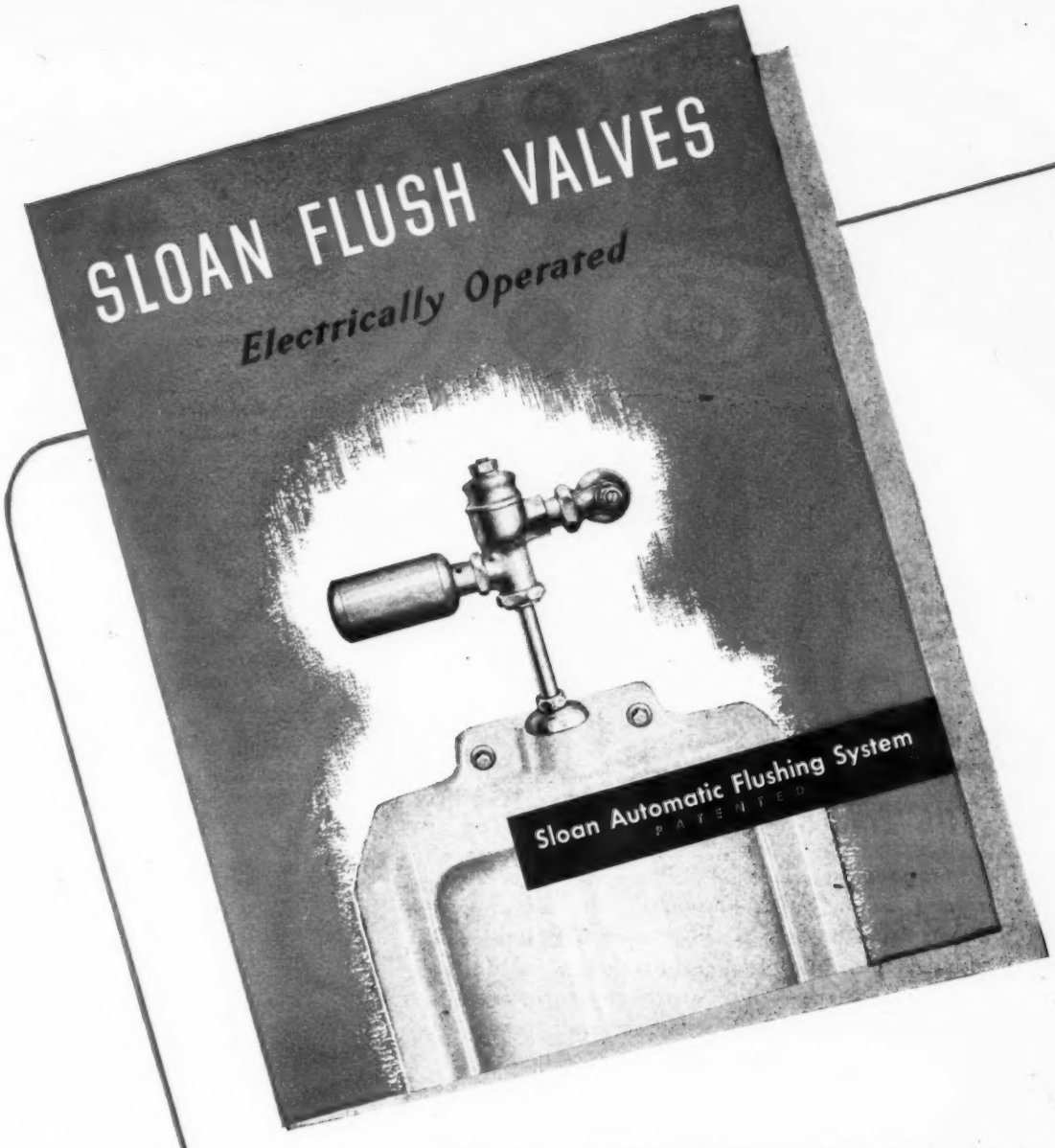
George T Deaney has been named purchasing agent of **Weston Electrical Instrument Corp,** Newark, N. J. He succeeds A R Briggs, who has retired after 45 years with the company.

Ward Leonard Electric Co, Mt. Vernon, N. Y., announce appointment of Storer and Schemm, Transportation Bldg, 307 E 4th St, Cincinnati 2, Ohio, as their new industrial sales representative in southern Ohio, eastern Ky., western part of W. Va., counties of Clark and Floyd in Ind.

After 26 years of service, Albert C Walsh, purchasing agent, has retired from **Timken Roller Bearing Co.**

Following men have been elected vice-presidents of **Permutit Co:** J D Yoder, D J Saunders, G N Proctor and H L Bechner.

Carborundum Co names John G Fritzinger district sales manager of Philadelphia sales office. Mr Fritzinger succeeds Williard J Griffith, who formed an industrial supply company with Paul E Raguse, who has resigned his position as industrial sales-



another Sloan first

The Sloan Automatic Flushing System is designed principally for the *automatic* operation of Sloan *urinal* Flush Valves—and is adaptable to *old* as well as new installations.

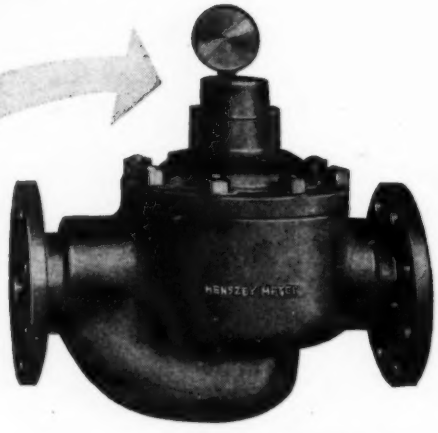
With Automatic Flushing in public or semi-public toilet rooms, neglect to flush urinals is entirely eliminated—more hygienic conditions assured—and better housekeeping of the toilet room encouraged on the part of building tenants, company employees, customers and the public.

In special installations such as sanitariums, hospitals, institutions and prisons, the responsibility of the individual to operate the flush valve is entirely eliminated with Automatic Flushing.

For further information, or information on your specific installation, write to the Sloan Valve Company, or address the Sloan representative in your territory.

Sloan Valve Company **chicago 24, illinois**

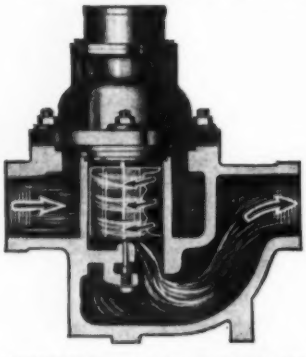
Accurately MEASURE *in* GALLONS, POUNDS, *or* CUBIC FEET!



HENSZEY *Feed Water* METERS

can be calibrated to suit your specific needs.

These simple rugged meters do an outstanding job of measuring boiler feed water, boiler blowdown, condensate, free-running chemicals, and other "hard-to-measure" liquids. The straight reading horizontal register accurately records any liquid at high or low flow — high or low pressure — on centrifugal or reciprocating pumps. They can be installed right in the line . . . no additional supports are needed.



If you have a liquid measuring problem that demands accuracy in readings of gallons, pounds, or cubic feet, consider the reliable Henszey Feed Water Meter. Ask for details.

SIMPLICITY WITH ACCURACY

Liquid enters the measuring chamber tangentially, spinning in the chamber as it passes through, forming a vortex. Each unit of liquid passing through this chamber makes the same number of revolutions. A vane placed in the liquid imparts this rotation to the calibrated register. A minimum of working parts without close clearances.

HENSZEY COMPANY

DEPT. D2, WATERTOWN, WIS.

HENSZEY

FEED WATER METERS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Boiler Feed Regulators • Flow Indicators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

man in Philadelphia area. The principal business of new company will be distribution of Carborundum products in Philadelphia metropolitan area.

Leeds & Northrup Co appointed Geare-Marston, Inc, New York and Philadelphia agency, to handle its publicity and public relations.

Alfred E Stacey Jr, one of the seven founders of **Carrier Corp,** is rejoining that organization. Mr Stacey will be process consultant to sales div. He will devote major attention to application of temperature and humidity control to industry.

Thermoid Co announces appointment of Andrew Richardson in charge of factory personnel relations. Tom Holden has been made head of employment office. Ferd Hanauer has been assigned as personnel assistant to W H Hall Jr, who is textile factory manager. Adrian Moore is in charge of Thermoid's "downtown" employment office, under Holden.

Joseph Glenn & Sons, Clifton Heights, Pa., are representing Manhattan rubber div of **Raybestos-Manhattan, Inc,** in Philadelphia area.

Blackmer Pump Co names John B Caldwell chief engineer, L R DeWolf and V A Brunson senior engineers.

Appointments of L H Moulton to post of national sales director, and of D T Buist assistant national sales director were announced by **Turco Products, Inc.** Their headquarters will be firm's main offices in Los Angeles.

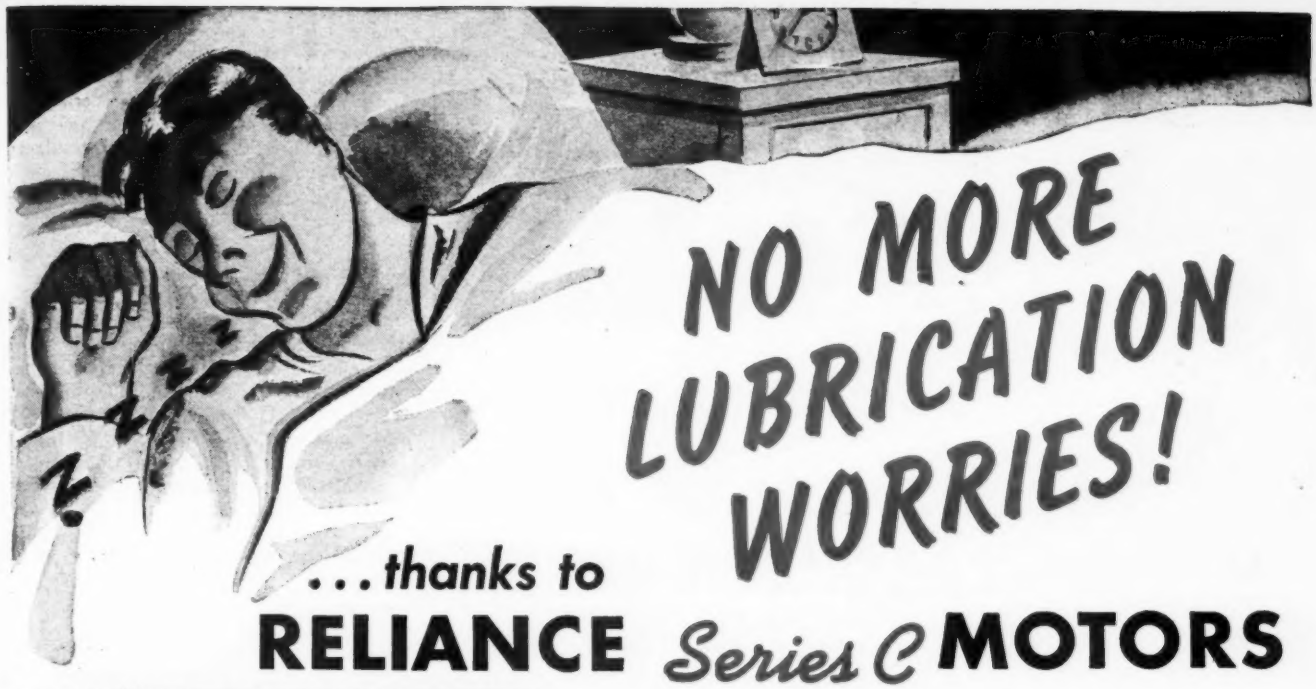
Colorado Fuel & Iron Corp elects A F Franz as vice-president in charge of operations. He succeeds Robert T Dunlap, who has resigned.

G S Parsons, after three years in the Army, recently opened a business in San Diego, Calif., as a dealer in equipment manufactured by **Lincoln Electric Co.**

Purchase of two local manufacturing concerns by **Portable Products Corp,** Pittsburgh, has been announced. The recent acquisitions are Great Western Fuse Co and LaMar Indicating Fuse Corp, both of 7633 Susquehanna St, Pittsburgh. Great Western Fuse Co has manufactured renewable electric fuses, lag fuses and similar products, and LaMar Indicating Fuse Corp has manufactured indicators for fuses. They will be operated as subsidiaries with no changes in personnel or methods of operation.

Hungerford Plastics Corp announces election of R M Ellis as vice-president. He retains his position as chief mechanical engineer.

Engineering Controls, Inc, took over assets and liabilities of Pacific Enterprise Products Co, a partnership which was dissolved on Oct 31, 1946. New corporation will engineer and manufacture its patented *Vapor Phase* systems, electric automatic



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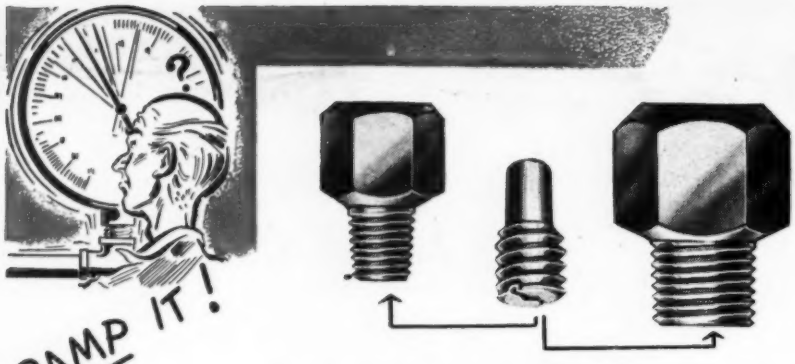

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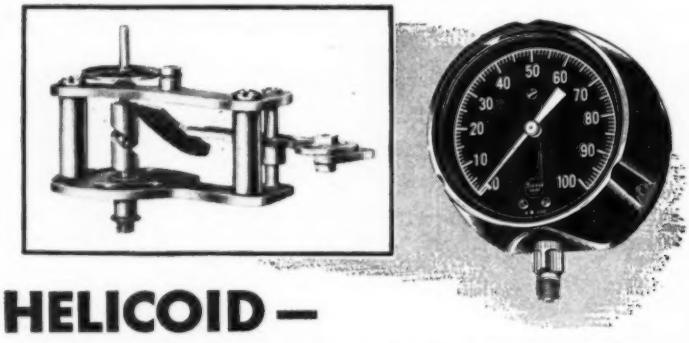
... for use where pulsations of gage pointer make accurate reading difficult or impossible. Damping action assured by porous cartridge of compressed, powdered bronze, threaded into gage socket or into snubber body. No adjustments ever needed. Specific porosity of cartridge makes it effective for required service – air, gas, water, steam or oil. Available for all pressures up to 10,000 pounds. May be supplied with Helicoid Gages or bought separately for use with other gages.



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HELICOID GAGE DIVISION
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engine controls and switchboards. Engineering of *Vapor Phase* will be under direction of Robert R Hull, and Alvin J Smith will have charge of engineering the electrical controls. Officers of the new corporation are L C Harbert, president; W G Corey, vice-president and chief engineer; and Forest W Monroe, secretary-treasurer.

Edwin E Whitehead has been appointed secretary of **Midwest Power Conference.** Dr Whitehead, who was recently appointed research professor in Illinois Institute of Technology's electrical engineering dept, will succeed Charles A Nash, IIT professor. When held March 31-April 2, 1947, the conference will be sponsored by Illinois Tech again in cooperation with other Midwestern colleges and universities as well as engineering societies.

Potter Instrument Co announces appointment of John J Wild as its new sales manager.

Richard L Bowditch, president and director of C H Sprague & Son Co and director of New River Co, has been elected president of **New England Council.**

Standard Brands Inc announces appointment of A C Foster to chief engineer.

Emmett W Hines has been made manager of New York zone of **Otis Elevator Co.** He replaces George A Mount, who is retiring after 34 years with Otis.

H K Porter Co has appointed Gilbert E Collyer district manager of its Detroit office.

G G Lail became assistant works manager of **Hanford Engrg Works** at Richland, Wash.

Reginald L Middleton has joined sales force of **Falk Corp** in Milwaukee as sales representative in Dallas territory. He makes his headquarters at 3304 Lovers Lane, Dallas.

W A Johnson, manager of metallurgical section of **Westinghouse** research laboratories, will set up and direct a new metallurgical div of the Clinton laboratories at Oak Ridge, Tenn., in connection with military and peacetime applications of atomic energy.

Fred D Knight was elected to succeed Vice-President Townsend H Soren, of **Hartford Electric Light** and **Connecticut Power** Companies, on the latter's retirement Jan 1, 1947.

Frederick R Lack, vice-president of Western Electric Co, becomes president of **American Standards Association.** George H Taber Jr, executive vice-president of Sinclair Refining Co, is named vice-president of the association.

Henry B Bryans, executive vice-president of Philadelphia Electric Co, was re-elected president of **Electrical Association of Philadelphia.** Other officers elected were: (1) *vice-president*—E W Loomis, district

Among the Problems on WATER TREATMENT Revealed in interviews with readers of a *Power Plant* PAPER

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BUT ANSWERS are not enough . . . The problems are actually solved

Back of the Dearborn Engineer is 50 years of experience in solving water problems.

In arriving at these correct answers, Dearborn laboratory experts and service engineers collaborate. Analyses and reports on plant conditions go from the field engineer to the laboratory. Then the answers come up . . . special chemical treatment formulations, adjustments, installation of proper feeding equipment, innumerable suggestions to eliminate your boiler water difficulties.

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90% open area assures maximum light and ventilation. Rectangular, square-edge bars provide a thoroughly safe, non-slipping, level walking surface. Write for detailed information.

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manager, Westinghouse Electric Corp (2) *treasurer*—Philip H Ward Jr, president, Ward Electric Co (3) *secretary*—Robert J Moran, chief of electrical district, Middle Dept Rating Association.

John R Shoffner, professional engineer, Kittanning, Pa., resigned as chief engineer of Allegheny River Mining Co and as chief engineer of Freebrook Corp and its affiliated companies. His offices have been moved to Empire Bldg, where he will continue his consulting engineering firm.

Carl A Miller & Co, 134 Lafayette St, New York 13, N. Y., has been appointed exclusive distributor for **Standard Transmission Equipment Co** of Los Angeles, Calif.

Frank Sutton and Atlantic Engineering Associates, consulting and industrial engineers in power plant, mechanical, electrical and sanitary fields, announce their consolidation under new name of **Frank Sutton Associates.** The address remains at 15 William St, New York 5, N. Y. Principals in the new organization are Frank Sutton, Kevin B Magee and Emil Gruenberg.

Otto E Zahn has retired from American Wheelabrator & Equipment Corp to set up his own consulting service for problems in patent research and development, product engineering, industrial engineering, metallurgical research and chemical and electrical engineering. Zahn's new office will be at 218 Napoleon Blvd, South Bend 17, Ind.

Carl W Flesher, Pacific Coast regional director of construction for U. S. Maritime Commission from 1942 to 1946, has become sales manager of Condenser Service & Engrg Co, Hoboken, N. J.

Federal Power Commission announces that Leland Olds asked to be relieved of the chairmanship. Commission elected Nelson Lee Smith chairman and Richard Sachse vice-chairman.

T Maseng & Associates moved their offices to Suite 1206, 7 S Dearborn St, Chicago 3, Ill.

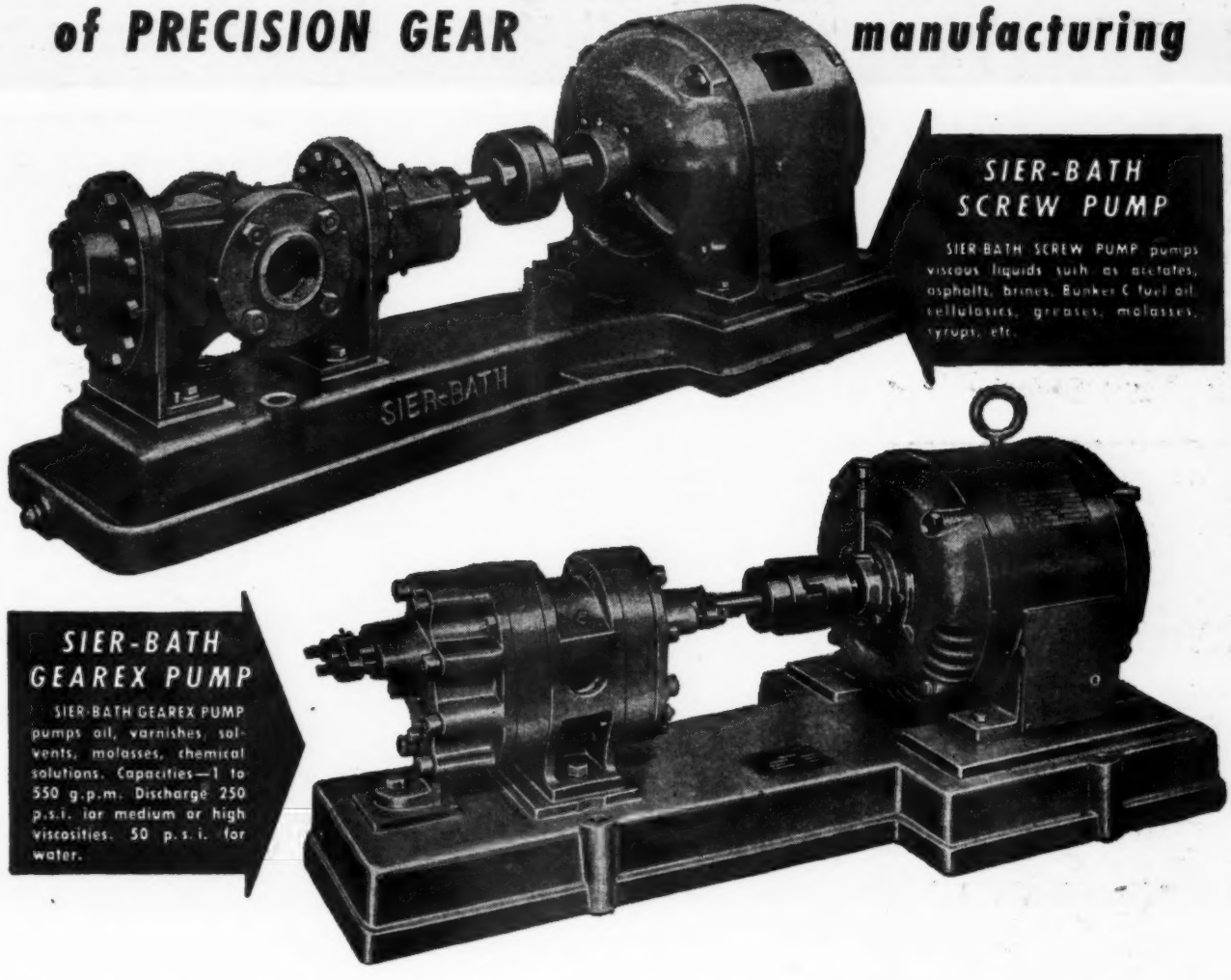
Nevin Elwell Funk, vice-president of Philadelphia Electric Co, has been named vice-president of **American Society of Mechanical Engineers,** Region III. He fills the vacancy created by death of Alexander R Stevenson Jr.

Harold Fox, formerly with General Electric Co and Warren Steam Pump Co, announces formation of Fox Engineering Co, 49 Federal St, Boston, Mass., representing a line of pumps, blowers, etc.

Bailey Meter Co has received a large order for steam-plant control for the Genevilliers power plant of the Union d'Electricite of Paris, France. Complete metering equipment and controls for six 530,000-lb-per-hr 1325-psi 980-F steam generators will be supplied.

SIER-BATH ROTARY PUMPS

are the natural offspring of PRECISION GEAR manufacturing



SIER-BATH SCREW PUMP

SIER-BATH SCREW PUMP pumps viscous liquids such as acetates, asphalts, brines, Bunker C fuel oil, cellulosics, greases, molasses, syrups, etc.

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SIER-BATH GEAREX PUMP pumps oil, varnishes, solvents, molasses, chemical solutions. Capacities—1 to 550 g.p.m. Discharge 250 p.s.i. for medium or high viscosities. 50 p.s.i. for water.

The better the gears and screws, the better the pump. Sier-Bath has been noted for designing and making the finest precision gears obtainable, for many years. Therefore, it is natural that Sier-Bath Gearex Pumps and Screw Pumps should have gained a high reputation for quality of service, in the short time since they were introduced.

Both the Sier-Bath Gearex Pump and the Screw Pump are made in horizontal and vertical models. They operate without vibration and discharge liquids without pulsation. Minimum wear and maximum life are assured because rotors are not in contact. Needle bearings maintain precision operation and provide greater load carrying capacity.

In every way, Sier-Bath Gearex Pumps and Screw Pumps are designed and produced to operate with the least possible maintenance. Write for detailed information.

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Lubricants protect machine parts against the destructive action of rust and corrosion. This feature alone puts LUBRIPLATE far out in front of conventional lubricants.

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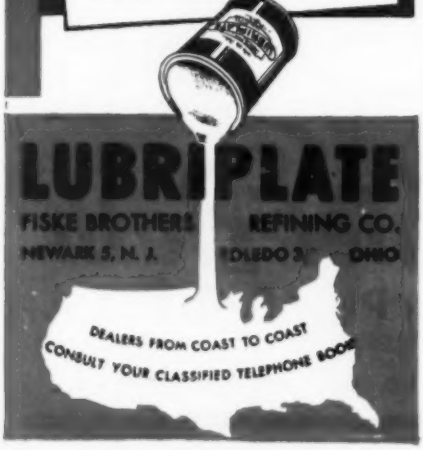
Lubricants are extremely economical for reason that they possess very long life and "stay-put" properties. A little LUBRIPLATE goes a long way.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OBITUARIES

Charles Edwards Stephens, 64, vice-president of Westinghouse Electric Corp when he retired last year, died at Delray Beach, Fla., Nov 20.

Arvid Peterson, chief engineer of centrifugal pump and compressor dept of De Laval Steam Turbine Co, Trenton, N. J., for 20 years, died Dec 19 after a short illness. A native of Sweden and a graduate of Royal Polytechnic University, he came to this country in 1905. At De Laval, where he started in 1907, he became one of the leading technicians in his field.

Fred Zonino, 59, chief industrial engineer of U. S. Rubber Co's footwear div, died Dec 1 of cerebral hemorrhage at Waterbury, Conn.

J Frank Davis, a supervisor for Virginia Transit Co and Virginia Electric & Power Co for more than 25 years, died Nov 21 at Richmond, Va.

Kennedy Park Jr, 62, engineer at John P Squire branch of Swift Packing Co, Cambridge, Mass., died at his home in Belmont, Mass., on Nov 25.

Clayton A Dunham, chairman of board of C A Dunham Co, died Nov 22 at Evanston, Ill., after a long illness.

Linwood L McGruder, 45, a foreman for Virginia Electric & Power Co, died unexpectedly Dec 2 of a heart attack at Richmond, Va.

John P Curley, 84, for many years employed as a stationary engineer by McLoughlin Hides & Tallow Co, died recently in Utica, N. Y.

Charles Mittendorf Cohn, 73, chairman of board of directors of Consolidated Gas, Electric Light & Power Co, of Baltimore, Md., died Dec 5 after being stricken with a cerebral hemorrhage.

George M Bohnert, 84, stationary engineer in Buffalo for many years, died of a heart attack in his home recently. He formerly served as stationary engineer at Erie Elevator and later at Montgomery-Mallue Inc. He retired several years ago.

William B Gold, 66, purchasing agent, Electric Storage Battery Co, Philadelphia, died suddenly on Dec. 15.

Dr George L Hoxie, research engineer who retired from Southern California Edison Co in 1938, died in Los Angeles on Nov. 14.

L Lewis Cohen, chairman of board of Union Asbestos & Rubber Co, died at his home in suburban Highland Park, Ill., Oct. 25 at age of 55.

Ben F Taylor, assistant advertising manager of American Air Filter Co, Louisville, Ky., died Dec 21.

Oscar Crosby, 85, pioneer executive of electrical and public utility companies and assistant secretary of treasury under President Wilson, died Jan 2. He was general superintendent of Sprague Electric Railway & Motor Co and general manager of railway dept of General Electric Co before close of nineteenth century, and subsequently headed utilities in Washington, D. C., Wilmington, Del., and Chester, Pa. He was a founder of Potomac Electric Co.

AJAX

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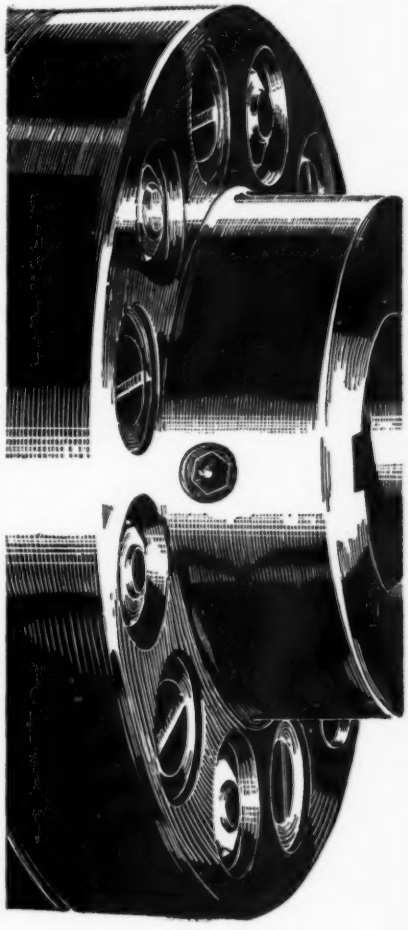

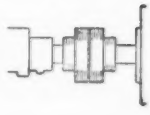

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1 **INDUSTRIAL EXHAUSTERS**—Buffalo Forge Co, Buffalo 5, N. Y. 32-page bulletin No. 3576 describes new Buffalo industrial exhauster. Three rotors are available, one for air handling, two for material.

2 **REFRIGERATION UNIT** — Henry Vogt Machine Co, Louisville, Ky. 16-page bulletin No. TI-2 presents Vogt automatic tube-ice machine. A complete description of tube-ice machine, process and the product, Vogtice, will be found in this booklet, together with applications in varied fields.

3 **CORROSION-RESISTANT FANS**—Duriron Co, Dayton 1, Ohio. 12-page bulletin on Durco corrosion-resistant fans gives complete engineering data, including dimensions and capacities of five standard sizes of fans made by the company.

4 **EVAPORATOR SYSTEMS** — Alco Products Div, American Locomotive Co, 30 Church St, New York 8, N. Y. 20-page booklet No. AP-1 features the Alco Flex-Tube evaporator. Alco is said to have succeeded in producing high output of pure water by a distillation system which is direct, efficient and trouble-free under all operating conditions.

BOILERS AND AUXILIARIES

5 **STEAM GENERATORS** — Springfield Boiler Co, 1965 E Capitol Ave, Springfield, Ill. 12-page bulletin contains detailed information on new Springfield line of standardized boilers for small and medium plants. Bulletin gives interesting data on points which should be considered in selecting boiler plants.

6 **SMOKE ABATEMENT**—Perfex Corp, Milwaukee, Wis. 16-page booklet, entitled "Smoke—Its Cause, Cost and Prevention," deals thoroughly with all phases of smoke prevention and offers a solution to this vital civic and economic problem.

7 **FIREBRICK PLANTS**—A P Green Engrg & Management Co, Div of A P Green Fire Brick Co, Mexico, Mo. 4-page booklet, entitled "For Tomorrow's Firebrick and Allied Clay Product Plants," explains purpose and function of newly formed div of A P Green Fire Brick Co. This company offers engineering and management service to refractory and allied clay plants throughout the world.

8 **SMOKE REDUCTION**—Technical Information Service, Bituminous Coal Research, Inc, 912 Oliver Bldg, Pittsburgh 22, Pa. 6-page reprint, entitled "Test Effect of Over-Fire Air Jets on Boiler Efficiency," by Richard B Engdahl and John H Stang, points out that fan-operated overfire air jets have little effect on boiler efficiency, yet they reduce smoke emission considerably.

9 **SCOTCH DRY-BACK BOILERS**—Dominion Bridge Co, Ltd, P O Box 280, Montreal, Que, Canada. 12-page catalog No. B101(E) gives typical dimensions of Scotch dry-back boilers and their applications in medium-capacity industrial steam plants.

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Be sure to fill out, completely, one coupon for each piece of literature you order. (See sample right.) This gives your request authority and helps the manufacturer to address your copy completely.

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Your Title .....
POWER, 330 West 42nd St., New York 18, N. Y. 2/47

10 **SMOKE PREVENTION** — Technical Information Service, Bituminous Coal Research, Inc, 912 Oliver Bldg, Pittsburgh 22, Pa. Technical report No. VII, entitled "Application of Overfire Jets to Prevent Smoke in Stationary Plants," by Richard B. Engdahl, discusses elimination of smoke from coal-fired stationary plants and gives practical information on overfire jets and their installation.

11 **OIL PREHEATERS**—Fluid Systems, Inc, 1881 Dixwell Ave, New Haven 14, Conn. 4-page folder presents the Lines Thermal Electric Conduction System for heating viscous liquids. This system utilizes a new principle that permits heating oil from a point inside tank to point of use. Temperature is thermostatically controlled throughout length of piping. 12-page booklet discusses Thermal Electric, which is claimed to move hard-to-flow liquids over any distance by heating the pipeline.

CONTROLS, ELECTRIC

12 **MOTOR STARTERS**—Electric Controller & Mfg Co, 2700 E 79th St, Cleveland 4, Ohio. Bulletins 1075-B, 1076-B, 1077-A and 1078-A describe synchronous motor starters for 600 v or less and also for 2300- to 4600-v service. Tables on rating and dimensions are given.

13 **RELAYS**—Ward Leonard Electric Co, Mt Vernon, N. Y. Bulletin No. 1 lists Ward Leonard representatives in U. S. and Canada and also gives the bulletin numbers in their line that are up to date. Bulletins 104, 105, 106, 108, 130 and 250 present midget metal-base relays, heavy-duty midget relays, midget magnetic relays, plug-in relays, sensitive relays, etc.

14 **THERMAL RELAY** — Instrument Div, Thomas A Edison, Inc, West Orange, N. J. 8-page publication No. 3007X presents Edison Model 501 thermal relay. This relay is a device in which electrically applied heat actuates a mechanism to make or break a pair of contacts.

CONTROLS, MECHANICAL

15 **WATER FEEDERS AND PUMP CONTROLLERS**—McAlear Mfg Div, Climax Industries, Inc, 1901 S Western Ave, Chicago 8, Ill. 8-page bulletin No. 126-A gives application and construction of McAlear boiler water feeders and electric pump controllers. Photographs, drawings and tables are given.

16 **TEMPERATURE CONTROL** — Claud S. Gordon Co, 3000 S Wallace St, Chicago 16, Ill. 4-page bulletin covers design, installation and operation of Xactline straight-line temperature control. A few typical applications are included.

17 **CARBON-MONOXIDE ALARM** — Mine Safety Appliances Co, Braddock, Thomas & Meade St, Pittsburgh 8, Pa. 4-page MSA bulletin No. DR-3 gives valuable information on action and symptoms of carbon-monoxide poisoning, a graph showing extent and effect of possible blood saturation with progressive concentrations of carbon monoxide in air.

18 **PNEUMATIC CONTROL** — Brown Instrument Co, Wayne & Roberts Ave, Philadelphia 44, Pa. 24-page catalog No. 5902 presents New-Matic remote transmission systems for applications where electrical transmission for indicating, recording and control of temperature, pressure, flow and liquid level is neither desirable nor permissible.

ELECTRICAL EQUIPMENT

19 **ELECTRICAL CONNECTORS** — Burndy Engrg Co, 107 Breckner Blvd, New York 54, N. Y. 64-page catalog contains complete specifications on Hydent electrical connectors for conductor sizes from No. 22 to 2000 Mcm. Line of Burndy installation tools is described also.

20 **SYNCHRONOUS TIMING MOTOR**—R W Cramer Co, Centerbrook, Conn. 4-page bulletin No. 10 describes new Cramer self-starting synchronous timing motor. Type SX synchronous motor is primarily for industrial applications in instrument and control field.

21 **OIL CIRCUIT BREAKERS**—Allis-Chalmers Mfg Co, 702, Milwaukee 1, Wis. 12-page bulletin No. 71B6421 discusses line of high-voltage, quick-clearing, outdoor, frame-mounted Unitop circuit breakers designed to meet latest ac power circuit breaker standards in ratings 15 to 46 kv, 500,000 to 1,500,000-kva interrupting capacity.

22 **LIGHT BULBS**—Lustra Corp of America, 40 W 25th St, New York 10, N. Y. 4-page bulletin No. 103 describes four light bulbs especially designed for rugged-duty service.

23 **ROTATING ELECTRICAL EQUIPMENT**—Electric Specialty Co, Stamford, Conn. 8-page ESCO catalog No. 46-1 presents ac, dc and universal motors; dynamotors and converters; motor-generator sets; ac and dc generators; gas and diesel electric-generating plants. General specifications cover main construction points, uses and range of electrical and mechanical characteristics to which other units can be manufactured.

24 **ILLUMINATION DESIGN**—Advertising and Sales Promotion Dept, Westinghouse Electric Corp, Bloomfield, N. J. 8-page booklet, entitled "Data for Designing Interior Illumination," contains easily read tables covering popular types of luminaires, lamps and ballasts.

25 **ELECTRONIC TUBES** — Westinghouse Electric Corp, P O Box 868, Pittsburgh, Pa. Booklet No. 86-020, entitled "Easy Guide to Electronic Tube Data," lists tubes according to "family" or class—Phototubes, Pliotrons, Thyratrons, Ignitrons, Kenatrons and Pianotrons —and gives all essential technical data on each tube.

26 **ELECTRIC TERMINALS** — Cincinnati Electric Products Co, Carthage at Hannaford, Norwood, Cincinnati 12, Ohio. 20-page catalog gives complete engineering data on Fusite terminals and HermetiCans. Details of design, construction and usage are shown for 32 different terminals. Specifications of Fusite HermetiCans for inclosing electric and electronic component parts and Fusite automatic sealer are covered also.

27 **ELECTRICAL DUCTS** — National Electric Products Corp, Chamber of Commerce Bldg, Pittsburgh 19, Pa. 12-page catalog No. 445 (revised edition) describes and illustrates 4x4 in. Wirewa. Catalog gives complete information regarding this inclosed metal duct for housing and protecting electric wires and cables.

28 **ELECTRICAL DUCT** — Bull Dog Electric Products Co, Box 177, Detroit 32, Mich. 24-page bulletin No. 462, entitled "BullDog Feeder and Plug-in BUStribution Duct," helps answer questions on description of a BUStribution duct system, how it is installed and what features it offers the purchaser.

(Continued on page 188)

FIRST CLASS
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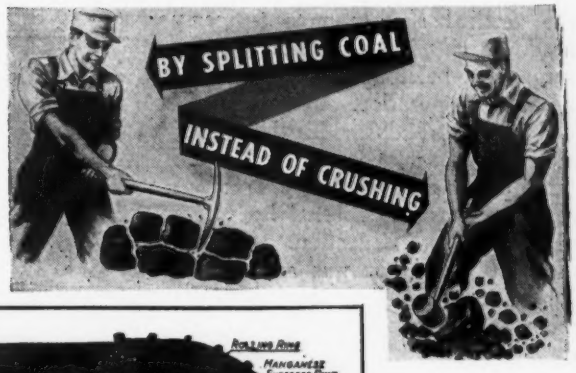
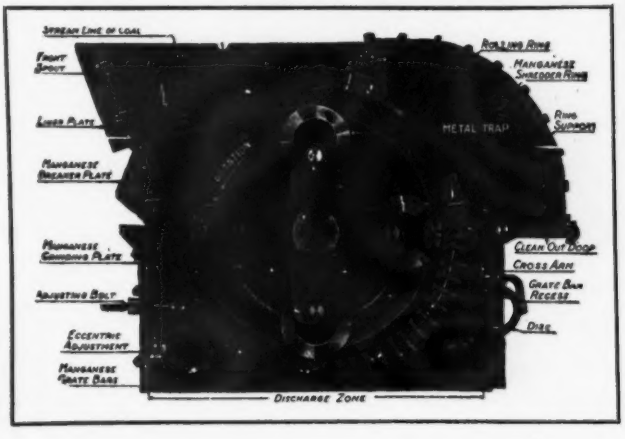
HERE'S HOW AMERICAN CRUSHERS GIVE YOU UNIFORM SIZING . . . . .

The rapid impact-splitting action of American Shredder Rings controls fines and passes no oversize . . . .

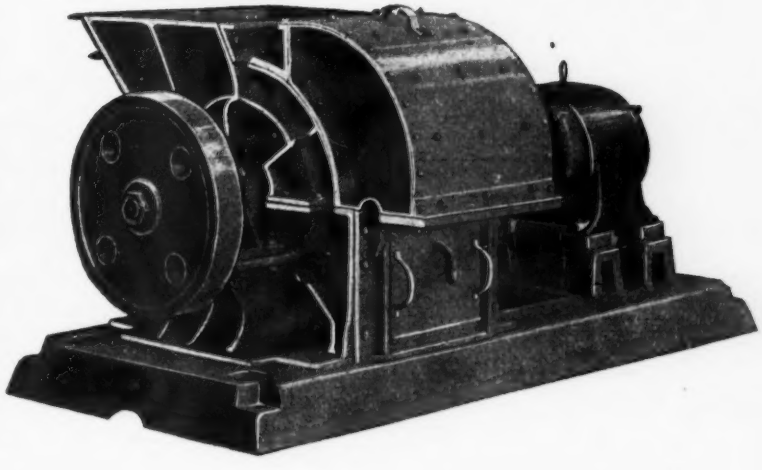


Patented manganese steel shredder rings with 20 cutting edges that split by rapid impact rather than crush—an exclusive feature of Americans.



Cross-section view of the American "S" Type Crusher showing rugged and compact design.

The American "S" Type Crusher



For consistent, high combustion efficiency from coal available in your field, uniform reduction is a necessity — and Americans rapidly reduce ROM or lump to uniform stoker or pulverizer size for improved firing and lower cost of handling. The uniform product of Americans improves stoker firing through decreased CO^2 loss and reduced ash-pit drop. Pulverizer feed operations are made more efficient by the uniformity of product decreasing the reduction loads on pulverizer mills. Exceptionally compact — requires minimum headroom — and no auxiliary reduction equipment nor extra operational manpower. Capacities up to 500 TPH.

Send for bulletin, "Crushing Coal At Less Than One Cent A Ton."

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 MACKLIND AVE.
ST. LOUIS 10, MO.

(Advertisement)

Ash in Sizable Pieces is Handled Efficiently with this Pump...

The ash produced by the boilers in a midwestern power plant is in sizable pieces, which would not pass through the vertical shaft pumps formerly used. Large pieces remained in the sump and built up until the pump became inoperative. Men formerly had to crawl down in the sump, after it was drained, and remove the large pieces manually. Too, frequent stoppage was necessitated by pieces picked up in the suction. Servicing the vertical pumps was an onerous job, as it meant removal of the units from their settings and a complete shop overhaul.

Excessive pump maintenance suggested a change to a horizontal shaft pump which could be installed at floor level. Amsco-Nagle Pumps were known to the power company, as Amsco manganese steel water ends were used on its vertical pumps for maximum service life under the severe abrasive wear of ashes pumping.

The priming problem was overcome by the use of Amsco's priming inductor, which makes priming practically instantaneous and requires no valves in either the suction or discharge line. To make possible the passage of a larger percentage of the bigger material, a larger pump was chosen. In view of past high pump repair costs, it was decided to operate the new pump at considerably lower speed than the original pump. As floor space was limited and head room more abundant, overhead motor mounting was specified.

The 8" Type "T," Frame 24 Amsco-Nagle Ball Bearing Horizontal Shaft Pump shown in Picture A-542 was

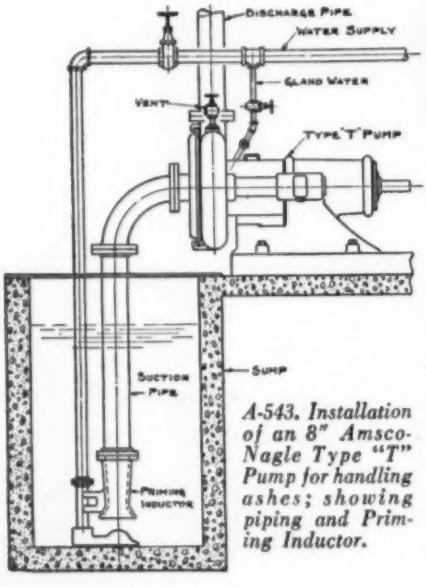
A-542. 8" Type "T" Frame 24 Amsco-Nagle ball bearing horizontal shaft pump with 50 H.P. 1200 R.P.M. overhead mounted motor and "V"-belt drive for handling ash. Accessibility to the unit is noticeable.

installed in this power plant in November, 1944. Sketch A-543 shows the installation, including the priming inductor. Accessibility is a valuable characteristic here.

The Amsco-Nagle pump has proved, in two years of operation, not only highly satisfactory from a low-maintenance standpoint, but has also eliminated the nasty job of manually cleaning the pump and suction line in this plant.

We welcome tough and unusual pump applications. Write for literature on Amsco-Nagle Pumps.

Joliette Steel, Limited, Joliette, Quebec, owned by American Brake Shoe Company, produces and sells Amsco Manganese Steel Castings in Canada.



A-543. Installation of an 8" Amsco-Nagle Type "T" Pump for handling ashes; showing piping and Priming Inductor.

AMSCO

Foundries at
Chicago Heights, Ill.; New Castle, Del.;
Denver, Colo.; Oakland, Calif.;
Los Angeles, Calif.; St. Louis, Mo.
Offices In Principal Cities

AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS • ILLINOIS

AMERICAN Brake Shoe COMPANY

New Bulletins

(Continued from page 186b)

MAINTENANCE AND SAFETY EQUIPMENT

29 **FIRE EXTINGUISHERS**—Fire Extinguisher Div, Ansul Chemical Co, Marinette, Wis. 16-page booklet, Form No. D-4620, discusses Ansul-Dugas dry-chemical fire extinguishers.

30 **BOILER-TUBE EXPANDERS** — Richard Dudgeon Inc, 24 Columbia St, New York 2. 6-page folder No. E-2 describes Dudgeon No. 16, 22, 28 and 42 tube expanders. Tables give size, weight and price of each expander.

31 **DRILLS AND REAMERS**—Whitman & Barnes, 2108 W Fort St, Detroit 16, Mich. 202-page catalog No. 100 contains valuable information on design, construction, use and care of drills and reamers. Many new designs are shown.

32 **METAL-WORKING TOOLS**—George Scherr Co, 200 Lafayette St, New York 12, N. Y. 96-page new 1947 Scherr tool catalog presents vernier calipers, comparators, gear testers, magnetic chucks, grinding attachments, etc. In addition, there is a section on transmission equipment.

33 **MOTOR MAINTENANCE TOOLS**—Holub Industries, Inc, Sycamore, Ill. 10-page catalog describes motor maintenance tools which conserve present equipment. Commutator and slip-ring resurfacing stones, polishing stones, commutator saws and milling cutters, carbon brush seaters, fuse reducers, etc, are included.

34 **AUGER BIT SET**—Bruno Tools, Beverly Hills, Calif. Catalog page describes new Bruno auger bit set. This set embodies a new principle—a single shank with several sizes of quick-change boring heads that enable operator to obtain instantly any size within range of set.

35 **MASONRY DRILLS**—Whitman & Barnes, 2108 W Fort St, Detroit 16, Mich. 4-page circular lists and illustrates carbide-tipped masonry drills. These drills may be used in electric or other portable drills, as well as in hand braces.

36 **METAL SCREENS**—Hendrick Mfg Co, Carbondale, Pa. 126-page catalog No. 46 lists perforated metals, screens and fabricated metals. Diagrams, charts and tables are included.

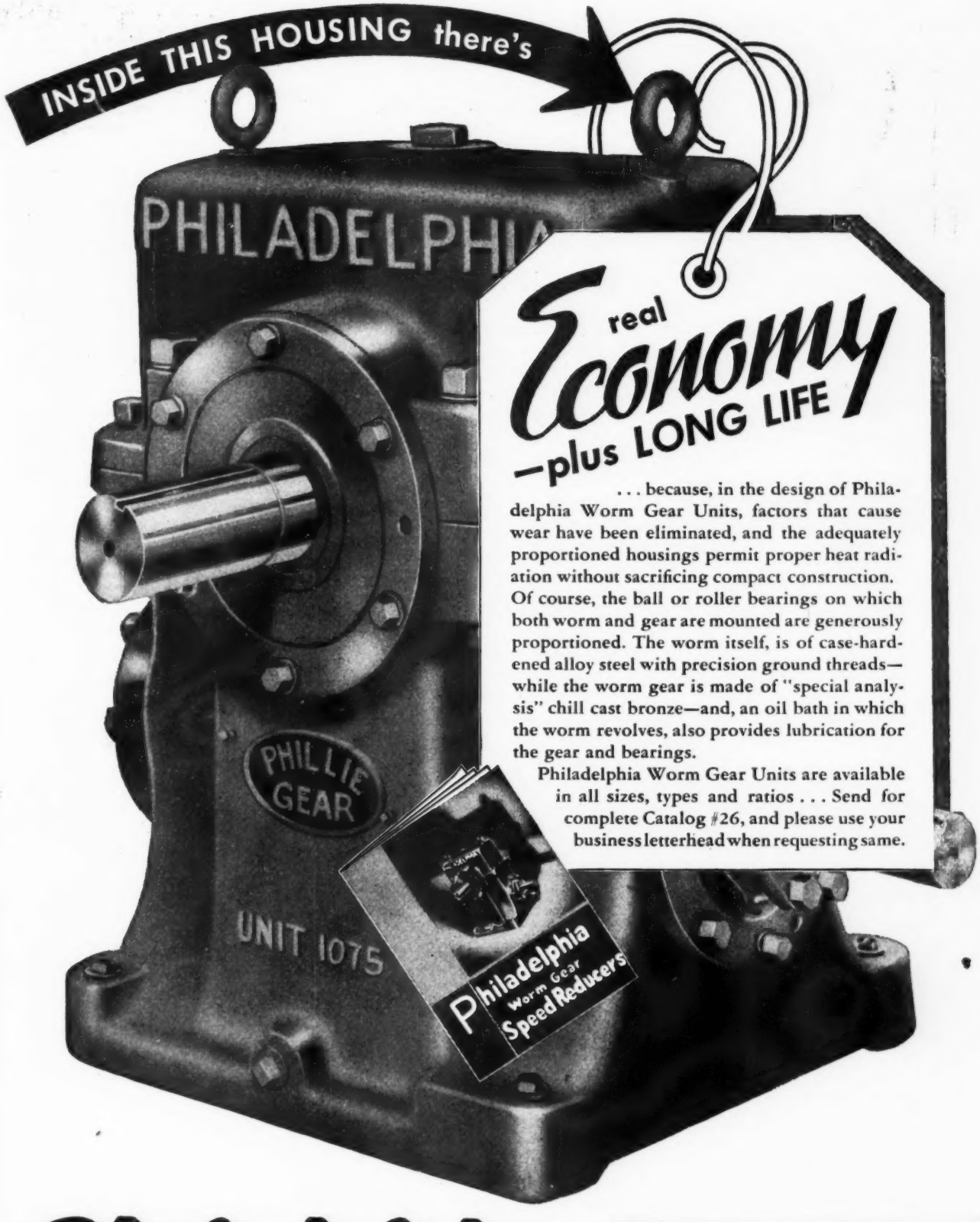
37 **TWIST DRILLS**—Republic Drill & Tool Co, 322 S Green St, Chicago 7, Ill. 24-page manual No. G-1 gives principles of sharpening twist drills. Manual contains data on proper care of twist drills and gives hints on sharpening and web thinning, as well as dimensions and angles of proper points for best results.

38 **HIGH-SPEED DRILLS** — Republic Drill & Tool Co, 322 S Green St, Chicago 7, Ill. 4-page bulletin No. RM-1 contains complete information on new Republic line of mechanics-length high-speed drills. They are available in fractional sizes from 1/16 to ½ in. dia and wire gage sizes from No. 1 through No. 34.

39 **DRILL FEEDS AND SPEEDS**—Chicago-Latrobe Twist Drill Works, 411 W Ontario St, Chicago 10, Ill. Chart, entitled "Safe Feeds and Speeds for High Speed Drills," gives drill operator a safe yardstick for drilling different material.

40 **EYE-PROTECTION EQUIPMENT**—Mine Safety Appliances Co, Braddock, Thomas & Meade St, Pittsburgh 8, Pa. 8-page bulletin gives a complete assortment of eye protection equipment for every application. Included in line are chippers' goggles equipped with MSA protective lenses, chemical goggles for protection against dangerous chemical particles and splashes, open-frame Ful-Vue spectacles, etc.

41 **PORTABLE LIGHTING UNITS**—Davey Compressor Co, Kent, Ohio. 4-page booklet contains specifications of floodlight, searchlight, combination and Beacon models. In addition to their lighting uses, DA-V-LITES can be employed to supplement existing power facilities or to provide motive power for electric tools.


INSIDE THIS HOUSING there's
PHILADELPHIA
PHILLIE GEAR
UNIT 1075
real Economy
—plus LONG LIFE
. . . because, in the design of Philadelphia Worm Gear Units, factors that cause wear have been eliminated, and the adequately proportioned housings permit proper heat radiation without sacrificing compact construction. Of course, the ball or roller bearings on which both worm and gear are mounted are generously proportioned. The worm itself, is of case-hardened alloy steel with precision ground threads—while the worm gear is made of "special analysis" chill cast bronze—and, an oil bath in which the worm revolves, also provides lubrication for the gear and bearings.
Philadelphia Worm Gear Units are available in all sizes, types and ratios . . . Send for complete Catalog #26, and please use your business letterhead when requesting same.
Philadelphia
Worm Gear
Speed Reducers

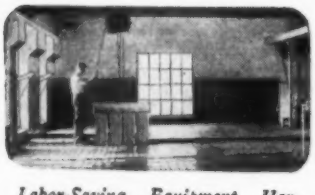
Philadelphia
GEAR WORKS INCORPORATED
ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO . . . . IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

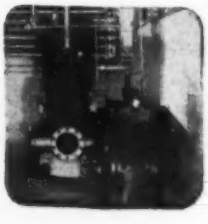
THE WILLIAMS-HAGER FLANGED SILENT CHECK VALVE is positive insurance against costly "Water Hammer"—built of materials to meet the requirements of any service, and pressures up to 6000 pounds. Write for new descriptive Bulletin WH-50 today.

THE WILLIAMS Gauge COMPANY
2055 PENNSYLVANIA AVENUE
PITTSBURGH 12, PENNA.

Typical Aisle in Locker Room, which has 1675 Compartments



Labor-Saving Equipment Harvests Four Ice Cans at Once



One of Seven Frick Machines

Georgia Community Refrigeration Center Makes Remarkable Growth

The City Ice Company of Gainesville started in 1929 with a 20-ton ice plant. Today it provides complete refrigeration services and operates 8 additional plants throughout Georgia, all being developed into Community Refrigeration Centers.

The original plant now makes 72 tons of ice daily; rents 1675 lockers; provides food processing and pork curing; operates extensive cold storages; quick-freezes up to 30,000 lb. of poultry per day; ices railroad cars and trucks; and sells refrigerators and appliances. The first Frick machine is still in continuous operation, six more have been added in this plant, and 15 more in the other plants.

What could a similar Community Refrigeration Center do for YOUR area? The nearest Frick Branch Office will supply details, or write

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.

42 OIL FILTERS—Greer Hydraulics, Inc, 454 18th St, Brooklyn 15, N. Y. 4-page pamphlet describes full line of micronic filters. Pamphlet discusses importance of oil cleanliness and hazards of contaminated oil.

43 EYE SAFETY GUIDE—American Optical Co, Southbridge, Mass. New eye safety guide lists industrial eye hazards by industries and recommends proper protective equipment.

MAINTENANCE MATERIALS

44 MECHANICAL PACKINGS — Greene, Tweed & Co, North Wales, Pa. 20-page condensed catalog No. PC-100 contains information on service applications, as well as construction and performance features, of the most widely used Palmetto packings.

45 BUILDING MAINTENANCE—A C Horn Co, 43-36 10th St, Long Island City 1, N. Y. First section of handbook gives compact technical data on all Horn products, such as flooring materials, exterior and interior coatings, roofing materials, waterproofings, dampproofings and admixtures. Second section contains useful tables, conversion factors, etc.

46 INDUSTRIAL LUBRICATION—Industrial Products Dept, Sun Oil Co, Philadelphia 3, Pa. 4-page folder, entitled "Sun 'Job-Proved' Products for Industry," discusses cutting oils, general lubricants, refrigeration oils, mine lubricants, rubber processing oils, textile processing oils, diesel oils, solvents, greases and waxes.

47 FLOOR MAINTENANCE — Walter Maguire Co, 330 W 42nd St, New York 18, N. Y. Bulletin No. 603, entitled "Cut Floor Maintenance," tells how major companies have reduced floor maintenance costs through use of Emeri-Crete flooring. This aggregate is mixed simply with cement and water to produce floors described and shown in the bulletin.

48 PROTECTIVE COATINGS—Walles Dove-Hermiston Corp., Westfield, N. J. Visual index shows industrial applications for different types of Bitumastic protective coatings. Center page of index contains a large composite drawing of a factory showing where Bitumastic and Bituplastic products can be used to prevent corrosion.

49 FUEL-OIL TREATMENT—E F Drew & Co, 15 E 26th St, New York 10, N. Y. 4-page bulletin presents Ameroid fuel-oil treatment for prevention and correction of unsatisfactory conditions in storing, pumping, heating and burning of industrial fuel oil.

50 CONCRETE FLOOR MAINTENANCE—Stonhard Co, 403 N Broad St, Philadelphia 8, Pa. 12-page folder, entitled "Concrete Floor Maintenance Pays Dividends," covers protective maintenance of concrete floors with Stonhard Stontop. This folder explains action of Stontop in stopping floor "dusting" and protecting against action of acid, grease, oil and abrasion.

51 OIL HISTORY—American Petroleum Institute, 50 W 50th St, New York 20, N. Y. 12-page brochure, entitled "Sunshine in the Rockies," tells the epochal story of the search for oil in Rocky Mountain states of Colo., Wy., Mont., Idaho and Utah.

52 METALLIC PACKING — Paxton-Mitchell Co, Omaha 5, Neb. Catalog shows major items in P-M metallic packing line. First section lists P-M standard piston rod packing assemblies, valve stem and tandem style rod packing assemblies, steam pipe slip joint assemblies and packing accessories. Second section gives data on Bearing Watchdog System which "inspects bearings while engine is running."

53 SELF-FLUXING SOLDER — Alpha Metals, Inc, 359 Hudson Ave, Brooklyn 1, N. Y. 4-page bulletin No. T-200-546-10 presents a new solder product, Tri-Core. Folder describes Tri-Core as a self-fluxing solder, with three cores located beneath outer wire surface.

54 MECHANICAL SEAL—Durametallic Corp, 2104 Factory St, Kalamazoo 24F, Mich. Bulletin No. 413 presents mechanically lubricated Dura Seal for sealing severe conditions at pressures up to 500 psi.

ONE *recognized standard*

THE COTTRELL PROCESS OF ELECTRICAL PRECIPITATION

FOR GAS CLEANING, smoke abatement and removal of dust, fume, tar and other suspended matter from gas, there has been one universally accepted process for more than thirty years. In answer to your special problem, a Cottrell installation incorporating this rich experience in research, development and worldwide operation means the complete fulfillment of your requirements.

RESEARCH CORPORATION

NEW YORK 17: 405 LEXINGTON AVENUE
CHICAGO 3: 122 SO. MICHIGAN AVENUE

CHECK the advantages of XZIT Firescale and Soot Eradicator

☐ From firebox to top of stack XZIT cleans out soot and firescale.

☐ XZIT does its work while boilers operate.

☐ XZIT can be used to extinguish stack fires and to stop sparking.

☐ Stack temperatures definitely prove that XZIT improves heat transfer, increases boiler efficiency.

☐ Used regularly, XZIT keeps boilers free of soot and scale—chipping and scraping are seldom necessary.

☐ Stocks are available in all localities—order a trial supply.

THERE IS AN XZIT SALES OFFICE NEAR YOU

XZIT

FIRESCALE & SOOT ERADICATOR

5800 S. Hoover St., Los Angeles, Calif.
158 14th St., Hoboken, New Jersey

MATERIALS HANDLING

55 CHAIN HOISTS—Chester Hoist Co, Lisbon, Ohio. 16-page bulletin covers complete line of spur-geared and differential chain hoists, together with Army low-headroom Timken-equipped trolley hoists. It is also filled with tables, section and photographic views of the various products, including a complete line of I-beam trolleys.

56 PORTABLE ELEVATORS — Revolvator Co, Tonnelle Ave at 86th St, North Bergen, N. J. 12-page bulletin No. 148 tells how to pile cases, rolls, boxes, crates, barrels, drums, bales and other material. Views of standard and special Revolvator portable elevators and other material-handling machines are shown.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **CABLE HOISTS** — Lisbon Hoist & Crane Co, Lisbon, Ohio. 8-page bulletin, entitled "Bob-Cat—A Super Line Electric Cable Hoists," gives design, construction, outstanding features, specifications and prices of these hoists.

MECHANICAL TRANSMISSION

57 FLEXIBLE COUPLINGS — Thomas Flexible Coupling Co, Warren, Pa. 58-page engineering catalog covers complete lines of standard Thomas flexible couplings. These couplings have no wearing parts and require no lubrication.

58 HYDRAULIC DRIVE — Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill. 16-page booklet No. 2085 describes Electrofluid Drive packaged power units that consist of a squirrel-cage motor and a hydraulic coupling for a wide variety of power applications.

59 RIGID AND FLEXIBLE COUPLINGS—Philadelphia Gear Works, Inc, Erie Ave and G St, Philadelphia 34, Pa. 16-page bulletin No. 150 (second edition) presents various couplings in rigid and flexible styles. Photos and tables are included.

60 POWER-TRANSMISSION EQUIPMENT—Boston Gear Works, Inc, North Quincy 71, Mass. 320-page general catalog No. 54 contains complete specifications and list prices on all stock sizes of spur gears, bevel gears, miter gears, helical gears, worms and worm gears, chain and sprockets, speed reducers, couplings, pulleys, ball bearings, universal joints, etc.

61 FLEXIBLE COUPLINGS — Farrel-Birmingham Co, Ansonia, Conn. 46-page bulletin No. 447, entitled "Farrel Gearflex Couplings," gives a clear description of coupling functions, plus recommendations of correct types for specific applications.

62 MAGNETIC PULLEYS — Stearns Magnetic Mfg Co, Milwaukee 4, Wis. Catalog No. 303 contains descriptive data, specifications, information on selecting for proper size, material, capacities, trajectory charts, use of double magnetic pulleys, as well as application suggestions and pictures.

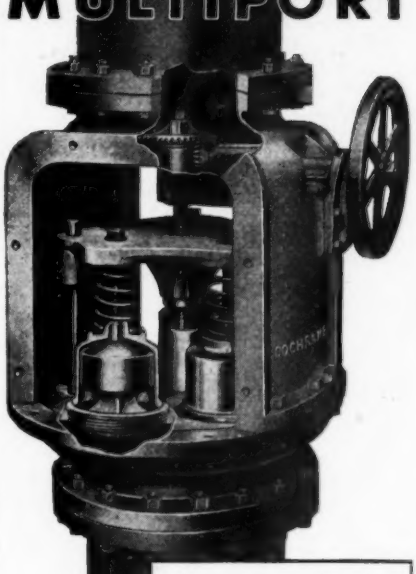
63 MAGNETIC BRAKES — Stearns Magnetic Mfg Co, Milwaukee 4, Wis. Catalog No. 604-D covers magnetic brakes for floor, motor and machine mounting.

METERS AND INSTRUMENTS, MECHANICAL

64 STRIP-CHART POTENTIOMETER —Brown Instrument Co, Philadelphia 44, Pa. 24-page catalog No. 15-10 presents ElectroniK strip-chart potentiometer. Electronic "continuous balance" operating principle and resulting advantages of ElectroniK strip-chart potentiometer are featured.

65 GAGES AND THERMOMETERS— Jas P Marsh Corp, 2073 Southport Ave, Chicago 14, Ill. 20-page pamphlet illustrates and describes company's latest industrial gages and thermometers.

MULTIPORT



Many small discs instead of one large disc
Reduces impact
Makes a tight valve
Insures against failure
Multiplies flow area

COCHRANE
SINCE 1863

SAFE!

No stuffing boxes

No levers

No weights

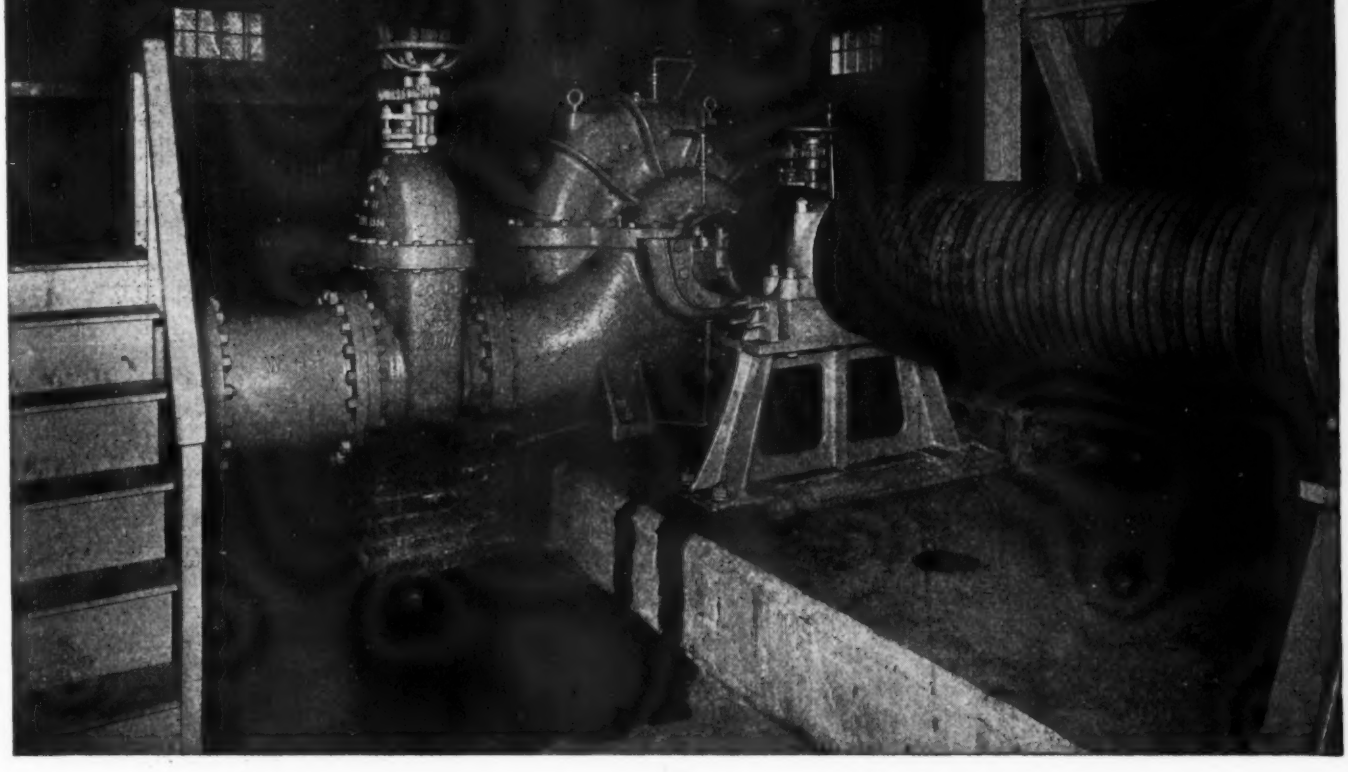
All moving parts inside the valve housing

The Cochrane Multiport Relief Valve, due to its unique and distinctive design with multiple valve discs instead of one large disc, insures continuous reliable operation without danger of sticking, jamming or freezing. Pressure can easily be adjusted by varying compression of the springs. Write for new Bulletin 4150.

COCHRANE
CORPORATION
3106 N. 17th St.
Philadelphia 32, Pa.

COCHRANE STEAM SPECIALTIES

It didn't happen...BUT



DURING the war the Metropolitan District Water Supply Commission of Boston was prepared to meet the emergency which *could* have occurred if its Chestnut Hill Pumping Station had been bombed or sabotaged.

Within an exceptionally short time . . . in a comparitively small space . . . the Commission built an emergency pumping station which had an available capacity of 45 million gallons daily in case of necessity.

To accomplish this, two Warren 18-DL-25 pumps were used, one direct-connected to a 900 HP motor and the other V-belted to a 1250 HP motor (see illustration). These pumps were originally built by Warren for de-watering service in the Quabbin Tunnel project of the Metropolitan District Commission. Thus Yankee ingenuity, plus the versatility of Warren Pumps and Warren engineering, made another worthwhile wartime contribution.

The same product and engineering skill is now available for peacetime projects. Ask for information.

If you have a pumping problem involving

- ☐ General Water Service
- ☐ Boiler Feed
- ☐ Paper Mill Services
- ☐ Process
- ☐ De-watering
- ☐ Condensate Return
- ☐ Oil Handling
- ☐ Hydraulic Pressures

. . . or other services, your inquiry will receive prompt attention.

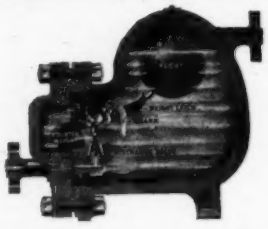
P2

WARREN STEAM PUMP COMPANY, INC. - - - WARREN, MASSACHUSETTS - - - *Able Representatives in Principal Cities*

WARREN PUMPS

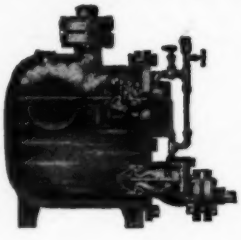
7 Reasons Why Nicholson Traps

REQUIRE



MINIMUM MAINTENANCE

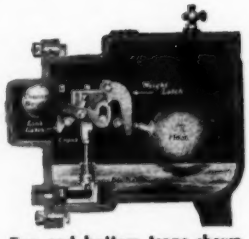
1) Leak-proofed by positive fluid seal over valve.
2) Not dependent on buoyancy or weight of float.
3) Unaffected by re-evaporation of condensate.
4) Non-wire drawing.
5) Rugged, to withstand unavoidable abuse.
6) Not easily affected by dirt, pulsation, etc.
7) Of stainless steel where it counts.



A TRAP FOR EVERY PURPOSE

In addition to a complete line of weight and piston-operated traps for steam, air and gasoline, Nicholson also furnishes: expansion traps for steam pressures to 225 lbs.; industrial thermostatic traps for pressures to 225 lbs.; and thermostatic radiator traps for pressures to 25 lbs. Let us send you . . .

CATALOG 444 or SEE SWEET'S

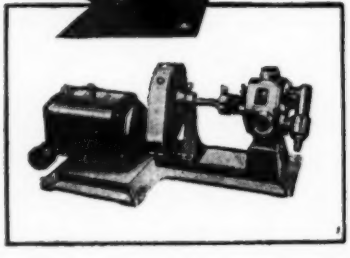


Top and bottom traps shown are weight-operated; middle, piston-operated. Pressures to 1500 lbs.

W. H. NICHOLSON & CO.

125 OREGON ST. 1, WILKES-BARRE, PA.

"We Have Used All Makes . . . FIND VIKINGS *the* BEST"



In a recent nation-wide survey, users were asked to comment on rotary pumps in use. Many fine compliments concerning the simplicity, ruggedness and dependability of Viking Rotary Pumps were received.

"Vikings extremely satisfactory on heavy work", one user reported. "Of all the pumps we have (and there are a great many) we like Vikings best" another said. "Viking is the best pump for our service. Buy nothing else", still another said. "Vikings do a wonderful job. Don't know what we would do without them," another said.

For complete information on Viking Rotary Pumps, write today for Bulletin Series 46SW. It will be sent free by return mail.

See Our Catalog In SWEETS

VIKING PUMP COMPANY

CEDAR FALLS, IOWA

66 PRESSURE GAGE—W C Dillon & Co, 5410 W Harrison St, Chicago 44, Ill. Bulletin presents new Dillon mechanical pressure gage for accurate indication of pressures or working loads in mechanical assemblies. Photos of gage are included.

67 THERMOMETERS AND PRESSURE GAGES—Brown Instrument Co, Wayne & Roberts Ave, Philadelphia 44, Pa. 20-page catalog No. 6707 gives features of rectangular-case thermometers and pressure gages. Bulbs, charts and interchangeable cases are fully treated.

68 PYROMETERS — Illinois Testing Laboratories, Inc, 420 N La Salle St, Chicago 10, Ill. 4-page bulletin No. 2982 on Alnor instrument line covers pyrometers for all types of service, electrical resistance thermometers, portable pyrometers, temperature controllers and the Alnor Velometer.

69 OXYGEN INDICATOR — Mine Safety Appliances Co, Braddock, Thomas & Meade St, Pittsburgh 8, Pa. 4-page bulletin No. DW-3 discusses applications and maintenance rules of MSA Type C oxygen indicator.

70 POSITIVE DISPLACEMENT METERS — Roots-Connersville Blower Corp, Connersville, Ind. 16-page bulletin No. 40-B-14 discusses construction features and advantages of Roots-Connersville positive displacement meters. Table of sizes, capacities, etc, is included.

PIPING, FITTINGS, VALVES AND SPECIALTIES

71 CONTROL VALVES—Foxboro Co, Foxboro, Mass. 36-page bulletin No. 277-1, entitled "Pneumatic Control Valves and Controller Accessories," features a color page showing various identifying enamel finishes offered on Stabilflo valves; plates and tables of specifications for control valves, needle valves, poppet valves and butterfly valves; separate sections on Vernier Valvactor for positioning of valve plungers, and on air switches and subpanels for remote valve control.

72 FLARELESS COUPLING — Parker Appliance Co, 17325 Euclid Ave, Cleveland 12, Ohio. 4-page booklet describes Ferulok flareless coupling for heavy wall tubing. Operating parts are shown.

73 PIPELINE COMPENSATORS—Chicago Metal Hose Corp, Maywood, Ill. Bulletin COM-1 presents specifications and data for installation of CMH compensators. These compensators are flexible tube members designed to compensate for, or absorb motion inherent in, general pipeline installations.

74 HOSE COUPLINGS—Hose Accessories Co, 2702G North 17th St, Philadelphia 32, Pa. 20-page manual on Le-Hi high- and low-pressure hose couplings gives short cuts for increasing efficiency and lowering operating cost of equipment using hose couplings and accessories.

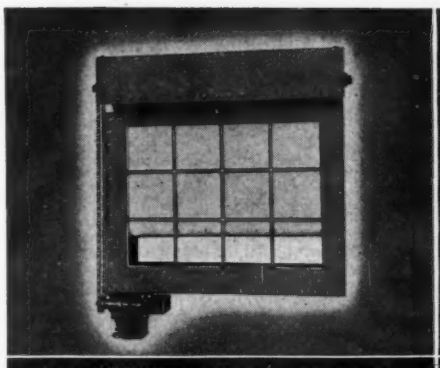
75 PIPE FITTINGS—Forged Fittings Div, Bonney Forge & Tool Works, Allentown, Pa. 18-page catalog on WeldOlet fittings tells where, why and how to use these fittings for making branch pipe outlets.

76 PRESSURE-REDUCING VALVES—Leslie Co, Lyndhurst, N. J. 20-page bulletin No. 461 gives engineering, operating and maintenance data on Leslie pressure-reducing valves.

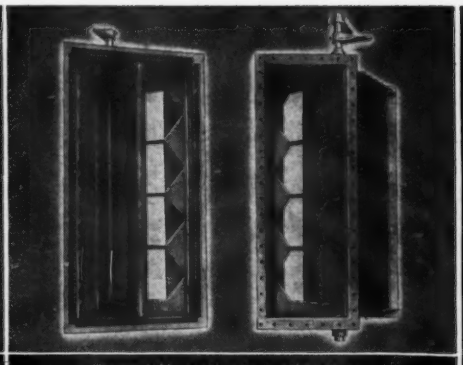
77 PIPING STRESSES—M W Kellogg Co, 225 Broadway, New York 7, N. Y. 8-page article, entitled "Analyzing Piping Stresses by Tests of Models," by Lale C Andrews, demonstrates advantages of solving flexibility of piping systems by model tests.

78 PIPES AND FITTINGS—B F Goodrich Co, Akron, Ohio. 8-page catalog section No. 9780 presents standard pipes and fittings lined with rubber by Vulcalock process. This section describes each of these linings and its functions.

79 NEEDLE VALVE—Kerotest Mfg Co, Pittsburgh 22, Pa. 4-page bulletin No. 46-N discusses a new needle valve for gage and metering lines, instrument lines, test lines, bleeder lines and other high temperature, high pressure or corrosive services.



Type SVH Heacon Damper motorized for combustion control.



Type LV vertical, inclined or horizontal duct.

Here's the Answer

. . . to your Damper Problem

Tightness—The Heacon Damper, when closed, eliminates leakage.

Control—Automatic or hand operated, Heacon gives smooth, accurate control. Constant differential across the damper gives an absolutely straight line flow characteristic.

Installation—Heacon Dampers may be adapted to your present system as well as to new installations of from 1,000 lbs. to 1,000,000 lbs. per hr. capacity and to numerous furnace and process applications.

The Heacon Dampers illustrated on this page are examples of the many types designed for specific uses. Our engineers will be glad to help you solve your damper problems.

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Project and Sales Engineers

FIRST NATIONAL BANK BLDG., GREENWICH, CONN.

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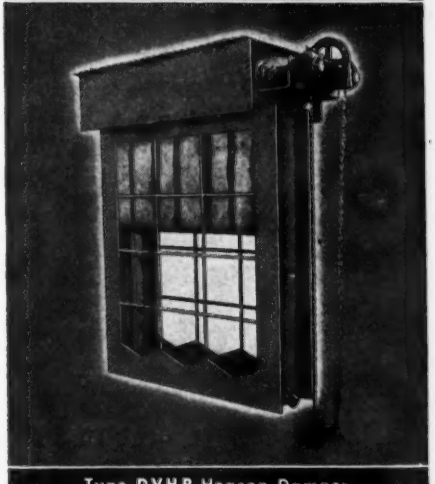
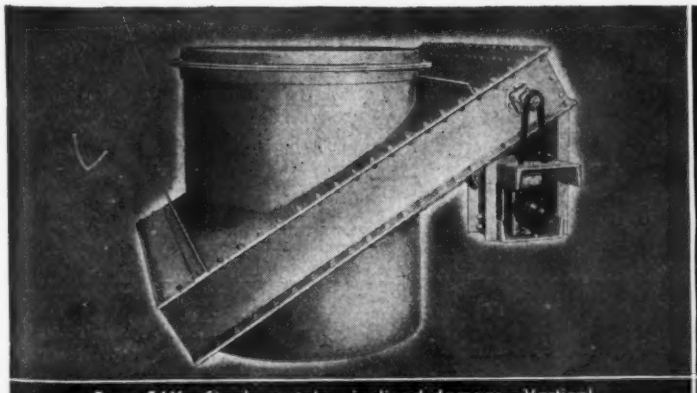
Type DVHR—Double curtain—Reversing flow. Regulates flow in either direction.



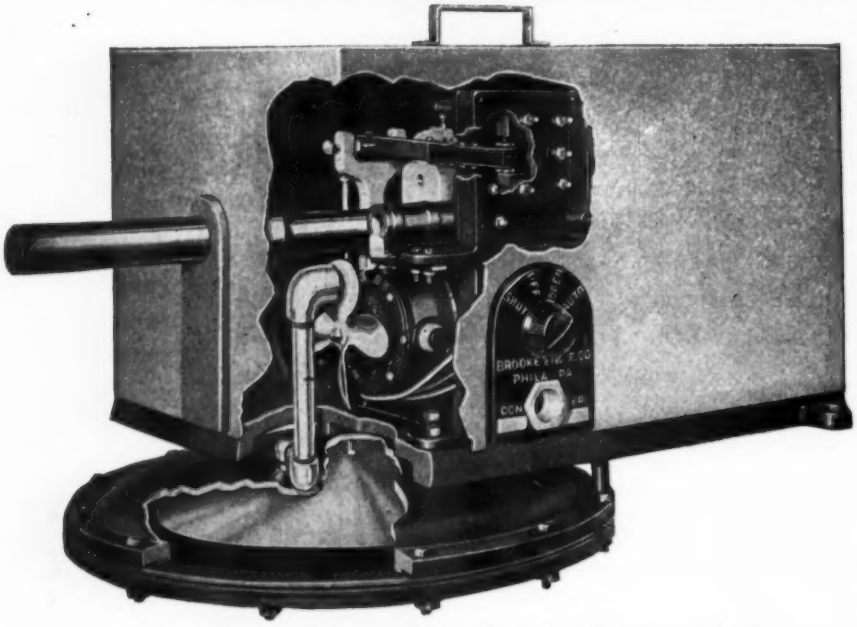
Type DVHR Heacon Damper controlling reversing flow in bypass in eastern airport.



Type SIV—Single curtain—inclined damper—Vertical duct. Regulates flow in one direction.

Type SVH Heacon Dampers for electric steel furnaces in one of the new steel plants.

ARE YOU WASTING FUEL BY . . . . . OPERATING YOUR STOP-START BURNER OR STOKER WITH THE DAMPER WIDE OPEN?



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Sequence is entirely automatic as follows:

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★ **2.** Switch on shaft of regulator closes when damper is wide open. This starts the burner and puts the regulator on, "AUTO." to maintain MINIMUM DRAFT. Damper closes to correct position to maintain minimum draft.

★ **3.** Steam pressure rises and shuts off the burner. Regulator runs to shut position automatically.

★ Note that damper is automatically shut whenever burner or stoker is not in operation.

Brooke Engineers are specialists in modern automatic high-accuracy boiler and furnace controls, and are available to advise you on your draft and control problems.

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80 MOTOR DIAPHRAGM VALVES—Kieley & Mueller, Inc, North Bergen, N. J. 30-page catalog introduces a new line of Kontrol motor pressure regulators and diaphragm motor valves.

81 PIPE COUPLING—Snyder Sales Corp, 5225 Wilshire Blvd, Los Angeles 36, Calif. 4-page booklet, Form SSC-1, gives construction and design of All-Flex ball-bearing swivel pipe coupling.

82 PORCELAIN PIPING AND FITTINGS—Illinois Electric Porcelain Co, Macomb, Ill. 8-page catalog No. C-2 contains informative data on porcelain piping, fittings, valves, expansion joints, flanges, sight glasses, ejectors, etc. Catalog also tells how their porcelain is made.

83 HYDRAULIC CONTROL HOSE—B F Goodrich Co, Akron, Ohio. 4-page catalog leaflet discusses construction and method of manufacturing high-pressure hydraulic control hose. A page is devoted to correct method for figuring correct hose length for various bending radii of various sizes of hydraulic control hose.

84 CORROSION-RESISTANT VALVES—Duriron Co, Dayton 1, Ohio. 20-page catalog H gives a general description of each type of corrosion-resistant equipment provided by the company. Durco equipment covered in this catalog includes: valves, pumps, heat exchangers, piping and fittings, nozzles, steam jets, ejectors, fans, etc.

85 SELF-CLEANING STRAINERS—Leslie Co, Lyndhurst, N. J. 8-page bulletin No. 465 describes Leslie self-cleaning strainers for steam, air, gas or liquid service. Photos, tables and diagrams are given.

PRIME MOVERS AND ACCESSORIES

86 DIESEL ENGINES — Caterpillar Tractor Co, Peoria 8, Ill. 8-page booklet, entitled "Designed for Durability," stresses features required in an industrial engine to cope with most rugged and exacting operations to which it is assigned.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **DIESEL-ENGINE COOLING SYSTEMS**—Binks Mfg Co, 3114 Carroll Ave, Chicago 12, Ill. 20-page booklet, entitled "Diesel Engine Cooling Systems," is a valuable addition to reference library of anyone interested in stationary diesel-engine efficiency and lower operating cost. It shows how water-jacket scale, overheating, costly breakdowns and insurance rates can be reduced or eliminated.

87 DIESEL ENGINES—Joshua Hendy Iron Works, Sunnyvale, Calif. 16-page booklet No. JHA-15 covers design of Series 50 and 60 Hendy diesel engines. Hendy Series 50 and 60 stationary diesels and diesel generator sets are discussed. 16-page bulletin JHA-11A presents features of Hendy Series 50 marine diesel engines.

88 DIESEL CONTROL EQUIPMENT—Landis & Gyr, Inc, 104 Fifth Ave, New York 11, N. Y. 4-page reprint covers operational control equipment for diesel-electric sets. Photographs and diagrams are included.

89 TURBINES—Allis-Chalmers Mfg Co, Milwaukee, Wis. 32-page bulletin No. 25B6150 discusses Allis-Chalmers' steam turbines, turbine generators, hydraulic turbines, engine generators, condensers and auxiliaries, pumps, water conditioning, motors, motor control, switchgear, circuit breakers, power transformers, distribution transformers and unit substations.

PUMPS

90 ACID- AND ALKALI-RESISTANT PUMPS—Worthington Pump & Machinery Corp, Harrison, N. J. 20-page bulletin No. W-350-B1H covers specifications, applications, sectional diagrams, performance curves of Worthington Type CG acid- and alkali-resistant pumps.

Take a WALWORTH No. 225P Bronze Valve Apart...

COMPARE IT PIECE BY PIECE

It will pay you to look inside the Walworth No. 225P. Compare the improved design, construction and convenience features shown in the "exploded" view. Notice the husky bronze body, the removable seat and disc, the oversize stem, all assuring maximum protection against wear and leakage.

Further, No. 225P is the TOUGHEST bronze valve your money can buy. The stainless steel, noncorrosive seats and discs are heat treated to a hardness of 500 Brinell – hard enough to scratch glass and crush nails. For this reason, the valve can be closed on sand, slag, scale and similar flotage without injury to the seating surfaces, and "wire drawing" is practically eliminated. Thus years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 227P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas or air.

For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular 82.

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CENTRIFUGAL PUMPS

Built for Regular or Special Pumping Applications where Temperatures and Pressures are Variable, and Normal, Dense or Viscous Liquids are to be Handled. Types illustrated represent a few of scores of Peerless Pumps for industrial applications.

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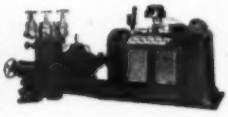
Underwriters Approved. Capacities: Up to 2,000 g.p.m.



Type XT (VANE) PUMPS
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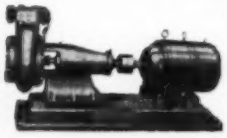
For Chemical, Oil, Food Processes, etc. Capacities: Up to 600 g.p.m.



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FOOD MACHINERY CORPORATION
Factories: 301 W. Ave. 26, Los Angeles 31, Calif. Quincy, Illinois – Canton 6, Ohio

91 **CLOSE-COUPLED PUMP**—Warren Steam Pump Co, Warren, Mass. 4-page bulletin No. 242 gives features of Warren Compacunit pump. Tables showing ratings and dimensions are included.

92 **TURBINE PUMPS**—Peerless Pump Div, Food Machinery Corp, 301 West Ave 26, Los Angeles 31, Calif. 20-page bulletin No. B-159, entitled "Peerless Vertical Close Coupled Turbine Pumps," describes and illustrates specialized application of Peerless turbine pumps to installations where short pump settings are encountered and where there is a strong necessity for deep-well turbine pump power and capacity in these applications.

93 **SEWAGE PUMPS**—Buffalo Pumps, Inc, Buffalo 5, N. Y. 32-page bulletin No. 964-D (revised edition) gives construction details, dimensions, installations and operating data on Buffalo vertical and horizontal sewage pumps, self-priming sewage pumps, sewage ejectors and single-suction sludge pumps.

94 **INDUSTRIAL PUMPS** — Nagle Brothers, Chicago Heights, Ill. 36-page bulletin No. 446 covers horizontal- and vertical-shaft pumps for abusive industrial applications. Equipment diagrams and photos are included.

WATER TREATMENT

95 **WATER CONDITIONING** — Allis-Chalmers Mfg Co, 710, Milwaukee 1, Wis. 12-page booklet No.28X6385, entitled "Allis-Chalmers Water Conditioning Chemicals and Equipment," discusses importance of feedwater control, care of testing equipment, obtaining samples and test procedures.

96 **ZEOLITE REGENERATOR**—International Salt Co, Scranton, Pa. Pamphlet describes operating economies that Lixate rock-salt dissolver produces in regenerating zeolite water softeners. Pamphlet points out that the Lixator is completely automatic, eliminates salt handling and produces pure, fully saturated, self-filtered brine.

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★ **WATER CONDITIONING** — Liquid Conditioning Corp, 423 W 126th St, New York 27, N. Y. 60-page bulletin G describes many different types of water-conditioning processes and explains applications, advantages and limitations of each type.

WELDING

97 **SEAM WELDERS** — Progressive Welder Co, 3050 E Outer Dr, Detroit 12, Mich. 8-page bulletin No. 803 gives information on design, operation and application of its improved standard and special seam welders.

98 **ARC WELDERS**—C E Phillips & Co, 2750 Poplar St, Detroit 8, Mich. 4-page bulletin gives instructions for making machinable arc welds in gray-iron castings with Phillips "600" electrode. The instructions include current settings, arc manipulation and preheating temperatures.

99 **WELDING RODS**—Eutectic Welding Alloys Corp, 40 Worth St, New York 13, N. Y. 4-page folder, entitled "Here Is Information on Eutectic," contains complete data on Eutectic low-temperature welding rods for torch and furnace applications and LowTemp Eutec-Trodes for arc welding.

100 **LOW-TEMPERATURE WELDING**—All-State Welding Alloys Co, 96 West Post Rd, White Plains, N. Y. 32-page booklet tells about savings resulting from use of low-temperature welding and also serves as a catalog and instruction guide for all products of All-State line. These products include rods for work on cast iron, steel, stainless steel, copper, copper nickel, nickel bronze and other copper-bearing alloys, zinc-base die castings, and aluminum; a galvanizing powder for cast iron; a powdered brazing compound and fluxes.

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TEMPERATURE REGULATORS

Use a Powers No. 11 Temperature Indicating Regulator when you want the advantages of an easy-to-read dial thermometer combined with a dependable self-operating regulator. The dial thermometer gives a visual check on the performance of the regulator and makes it easy to adjust for the required operating temperature. Various dials and ranges are available.

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OF AUTOMATIC TEMPERATURE AND HUMIDITY CONTROL

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Operators and builders of steam power plants reduce outages and maintenance costs by using LUMNITE cement for concrete linings in coal bunkers, ash pits, cinder catchers, stacks, flues and ducts. Here are just four of LUMNITE'S many advantages:

1. **Ease of Installation.** Lumnite concrete linings are cast in place to exact shape and size required. For thin sections, as in flues and stacks, linings are shot on with a cement gun or plastered by hand.

2. **Resistance to Heat, Corrosion, Abrasion.** With aggregate selected according to service requirements, LUMNITE makes concrete to withstand high temperature, sulphurous flue-gas and fly-ash, or corrosion from bunkered coal and cinders.

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PILLOW BLOCKS

There's Extra Value in these rugged, well-designed Standco Pillow Blocks with their life-long, trouble-free service.

They are fully able to "take it," and have babbitted, accurately broached bearing surfaces, with faces machined to a "T". Easy to clean, easy to lubricate.

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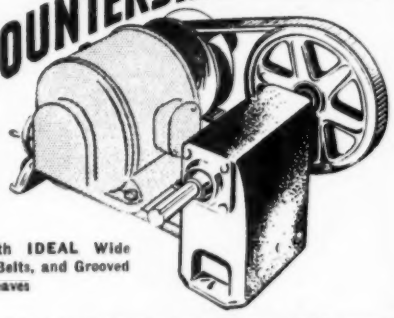

With IDEAL Wide V-Belts, and Grooved Sheaves

- For thousands of uses where variable speed was formerly impossible.
- For speed-up or slow speed drives. 3:1 speed ratio.
- Multiple reduction. Applicable in space limitations.
- Accurate, instant finger-tip control of speeds.
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- All metal. Non breakable steel sheave. Pressure lubricated.

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Mfrs. Lovejoy Flexible Couplings
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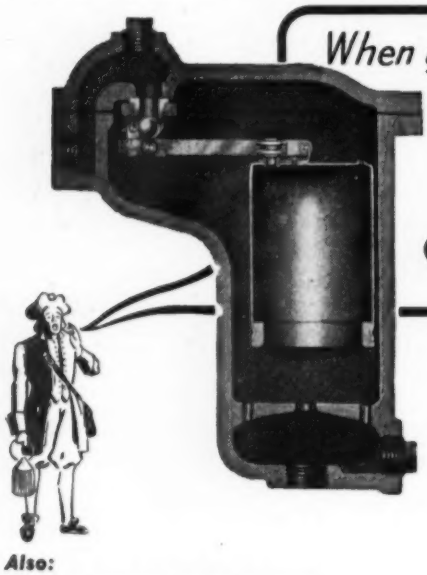

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You simplify maintenance

"All's well with
CRYER TRAPS"

Sizes: ½" to 2½"
Capacities: 500 to 38,000# water
Pressures: to 250#

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... they have ample capacity for the job they have to do.

Full details on request

Also:

Cryer Thermostatic Radiator Traps in ½" and ¾" sizes, for pressures up to 30#.

Encor Strainers for 250# steam pressure or 400# pressure cold water, oil or gas. Sizes ½" to 3".

Cryer Ball Steam Traps (Formerly known as the J-M Trap). Sizes from ¾" to 2", "Junior" Model, ½".

CRYER TRAP AND VALVE CO., INC.

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Manufacturers of Steam Specialties for more than 40 years.

101 WELDING EQUIPMENT—Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y. 64-page catalog is divided into two sections: one for oxyacetylene welding and cutting gases, equipment and supplies; the other for arc-welding machines, accessories and electrodes.

102 AC WELDERS—Westinghouse Electric Corp, P O Box 868, Pittsburgh 30, Pa. Booklet No. B-3548 contains construction details, electrical specifications and application data on complete line of ac transformer welders.

103 WELDING TECHNIQUE — Ampco Metal, Inc, Milwaukee 4, Wis. 16-page bulletin No. W-2A features welding of aluminum bronze electrodes by carbon and metallic-arc methods. Bulletin is illustrated by 22 photographs, sketches and diagrams and contains tables of recommended currents and voltages.

104 WELDING CONTROL — Industrial Electronics Div, Raytheon Mfg Co, Waltham 54, Mass. 4-page folder gives construction features and specifications of Raytheon synchronous welding control. Photographs are included.

105 ARC WELDING—Ampco Metal Inc, 1745 S 38th St, Milwaukee 4, Wis. Two new arc-welding procedure sheets, entitled "Ampco Procedure for Welding Silicon Bronze," and "Ampco Welding Procedure for Beryllium Copper," discuss the recommended electrode, polarity and current, preparation, preheat and detailed technical data on welding of base metal under consideration.

106 WELD TIMERS—Apparatus Dept, General Electric Co, Schenectady, N. Y. 8-page booklet No. GEA-3318B presents an improved line of sequence and sequence-weld timers for resistance welding. Functions, modifications and accessories are included.

107 RESISTANCE WELDING — Ampco Metal, Inc, 1745 S 38th St, Milwaukee 4, Wis. 20-page bulletin No. 68A describes Ampcoloy resistance-welding electrodes and alloys. Included are diagrams and information covering a new line of water-cooled electrode holders. A large selection of spot welder tips is offered and list of seam-welder wheels has been greatly enlarged.

108 RESISTANCE-WELDING CHART —Ampco Metal, Inc, 1745 S 38th St, Milwaukee 4, Wis. New chart, entitled "Comparative Resistance Welding Alloys," lists by groups, classes and trade names, alloys produced by Ampco and seven other companies serving resistance-welding field. RWMA minimum properties for each group and class are also published.

OTHER EQUIPMENT

109 PREFORMED WIRE ROPE—Preformed Wire Rope Information Bureau, 520 N Michigan Ave, Chicago 11, Ill. 16-page booklet, entitled "Speaking of Preformed," gives the answers to a questionnaire asking users, "What do you think of preformed wire rope?" Ten questions were asked relative to use, performance and value of preformed. The answers are informative.

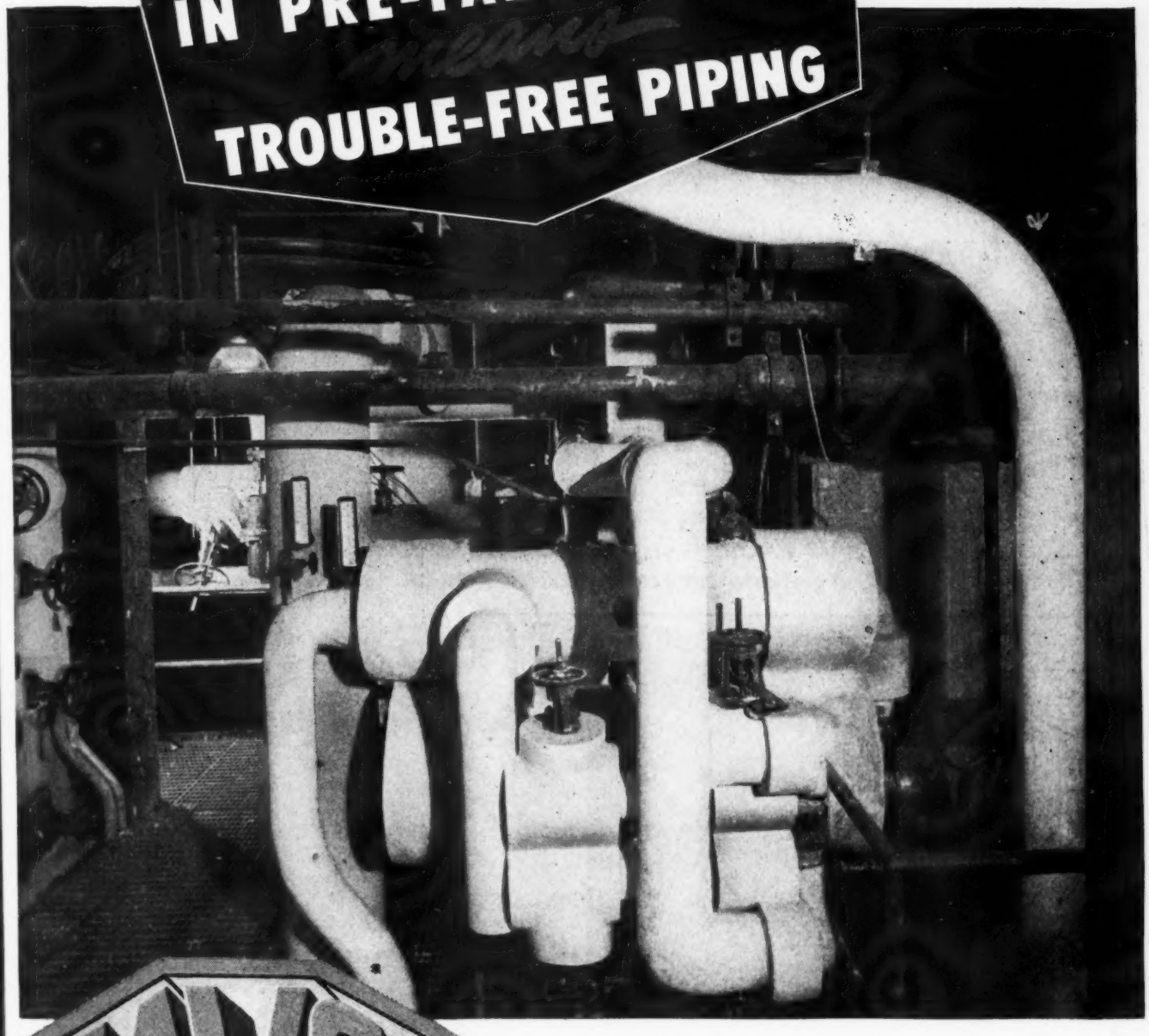
110 PROTECTIVE PACKAGING PROCESS—Coatings Div, R M Hollingshead Corp, Camden, N. J. 12-page booklet, Form No. 5559, presents Cocoon, a new packaging plastic. It is based on modified film-forming resins, carried in volatile solvents. It provides a simple, quick efficient means of packaging parts, assemblies or complete machines.

111 SYNTHETIC RUBBER — Publicity Dept, U. S. Rubber Co, Rockefeller Center, New York 20, N. Y. 50-page booklet, "Five Years of Synthetic Rubber," shows growth of synthetic rubber industry and gives an appraisal of its importance today.

112 PREFORMED WIRE ROPE—Preformed Wire Rope Information Bureau, 520 N Michigan Ave, Chicago 11, Ill. 24-page booklet, entitled "Preformed Wire Rope—What It Is—What It Does," tells story of development of preformed wire rope and what that development has meant to all industry.

113 HEAT EXCHANGERS—Sims Co, P O Box 1096, Erie, Pa. 16-page booklet No. HR-2 discusses Sims heat exchangers and exhaust-gas fired boilers. Sizes and dimensions are included.

NAVCO ACCURACY IN PRE-FABRICATION TROUBLE-FREE PIPING



NAVCO

Prefabrication accuracy is an essential "MUST" to assure a proper fit and economical operation. Navco's 40 years' experience in fabricating assemblies in all sizes and for all operating conditions is your assurance of such accuracy.

Consult Navco for your next piping job.

NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

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Here is a Sauerman Power Scraper (1½ cu. yd. in capacity) storing coal at rate of 75 tons an hour; making a high, compact pile that fills an area alongside power plant. Scraper can be turned around in a jiffy to reclaim from any part of area. Shifting block in this installation is attached to trolley running on monorail.

It's Easier, Cheaper, Faster

WITH THE

SAUERMAN

One-Man Scraper System

Hundreds of users can tell you how it has put handling and storage on the most economical basis—how it makes better, safer stockpiles, and reclaims coal at only a few cents per ton.

The Sauerman Power Scraper is a *one-man* machine that serves as a self-loading conveyor, with large handling capacity, and long reach. It utilizes full ground space, any size or shape. It builds higher piles, free from air-pockets. It protects from spontaneous combustion. Reduces dust.

There's a Sauerman Power Scraper System to suit your special needs. Our engineers will be glad to advise you.

Write for Complete Illustrated Catalog

SAUERMAN BROS., Inc.

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HIGH EFFICIENCY

TUBE EXPANDERS

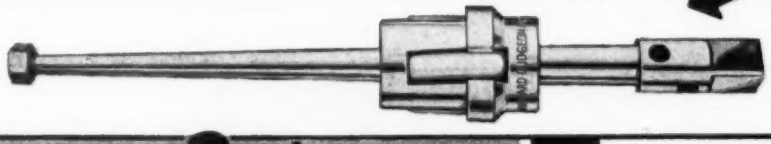
... meet all job requirements!

Combining new methods of production, aggressive research in design, and positive quality control on every tool, DUDGEON Expanders offer "custom built" efficiency, at prices based on volume production.

In new construction and for maintenance—wherever tube expanders are required — there is a DUDGEON Expander to fit the job . . . to do a better job, and do it faster!

DUDGEON TYPE 16

An all-purpose, low cost tool highly suitable for railroad maintenance or general boiler repair. Manufactured to the well-known DUDGEON standards of workmanship and materials, it provides a simpler, more rugged expander for all tube sizes and tube sheet thicknesses usually requiring higher priced tools. Model 16 has only three parts — hardened steel frame; hardened tool steel tools; hardened tool steel mandrel.



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MFRS. OF TUBE EXPANDERS SINCE 1853

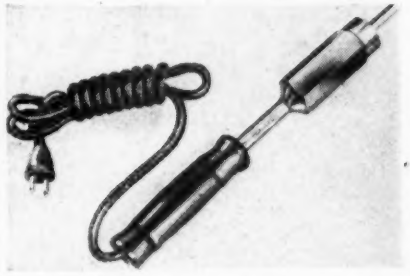
24 COLUMBIA STREET, NEW YORK 2, N. Y.

Complete literature on DUDGEON products — expanders, hydraulic pumps and jacks — available. Write Department G.

New Equipment

(*Continued from page* 130)

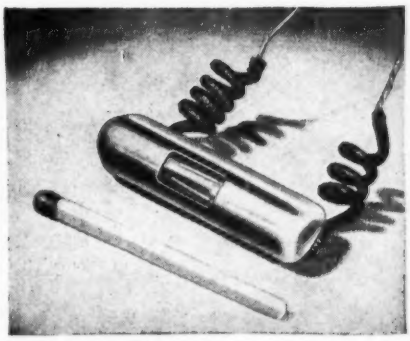
mica, silica, or carbon. *DC*-2103 is unique among thermosetting resins for its high heat stability, low water absorption, excellent insulating properties over a wide frequency range, and for its resistance to carbon tracking. **Dept. P, Dow-Corning Corp, Midland, Mich.**



Soldering Iron

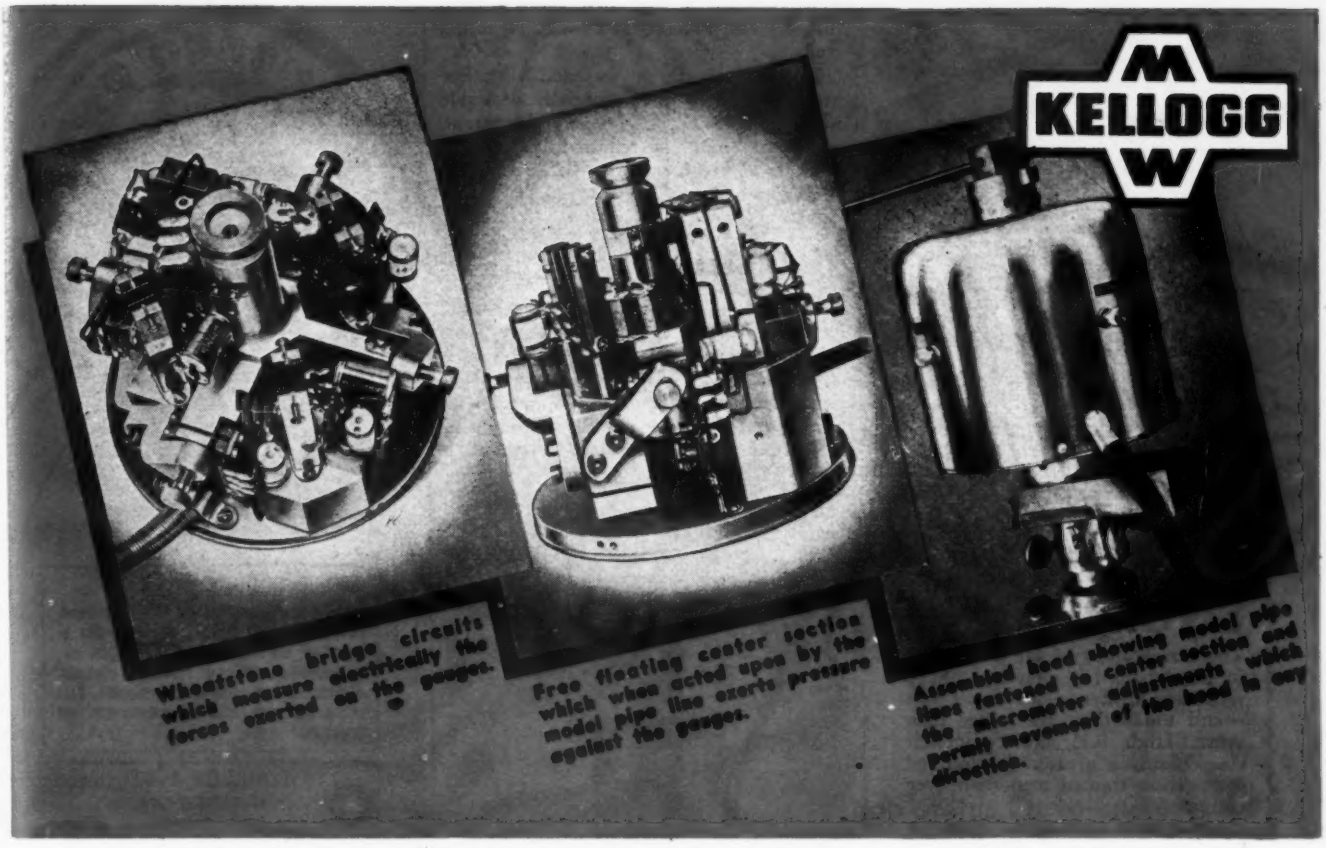
A 300-WATT SOLDERING IRON with a ⅜-in. tip, instead of the conventional ¼-in.-diameter tip, is especially recommended for fast production-line soldering. Heating element for this *Hexacon* unit is in a damage-proof hexagonal barrel that protects it from all danger of mechanical injury.

Heating element is made of first-grade nickel-chromium resistance wire, insulated with mica. Tips, made of hard-drawn copper, are easily replaceable in all irons. Case is made of steel for greater mechanical strength. The easily accessible terminals are constructed to relieve cord strain. Its smooth, cool, comfortable handle is readily replaceable. The *Hexacon* operates on ac or dc. **Dept P, Hexacon Electric Co, 131 W Clay Ave, Roselle Park, N. J.**



Pilot Light

MAXIMUM INDICATION in minimum space is characteristic of *Tiny-Glow* neon pilot light. Housed in a heavy metal casing this miniature neon lamp consumes less than one-tenth watt, and operates at any voltage from 75- to 250-v ac or dc. It has an operating life of over 10,000 hr of actual burning time. Unit, in polished chrome plating, requires only two 13/64-in. holes in panel or mounting surface. Standard mounting studs are ⅜ in. long, but other lengths are available on request. Connec-


M
KELLOGG
W
Wheatstone bridge circuits which measure electrically the forces exerted on the gauges.
Free floating center section which when acted upon by the model pipe line exerts pressure against the gauges.
Assembled head showing model pipe lines fastened to center section and the micrometer adjustments which permit movement of the head in any direction.

These Heads Measure Load Deflections to ONE-MILLIONTH of an INCH

These super-sensitive instruments were designed and are used exclusively in the Kellogg Engineering Department for the benefit of Kellogg piping clients.

By using the Kellogg model testing apparatus, the most complicated design problems of high pressure, high temperature piping assemblies are solved accurately and quickly.

The "bugs" are found and eliminated before the final drawings go to the shop. This design research service is available to consulting, power, process and marine engineers.

A new bulletin "Analyzing Piping Stresses by Tests of Models" has just been issued. Write today for your copy.

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"Masterlize" Prefabricated Piping Systems . "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization Thermal and Catalytic Polymerization Units . JUIK Processes for Lubricating Oil Plants . Plastic Refractories . Radial Brick Chimneys.

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tions are made through 4-in. long insulated tinned leads, which pass through mounting studs.

Tiny-Glow is for shock- and vibration-proof operation. It is especially desirable where a high-visibility, negligible-current, cold pilot light is required. **Dept P, Industrial Devices, Inc, 22 State Rd, Edgewater, N. J.**

Hand Cleaner

WATERLESS, ABRASIVE-FREE HAND CLEANER, its manufacturer claims, removes dirt, grime, grease. *Disolvit*, treated with pine oil for germicidal aid in preventing occupational dermatitis, requires no water for its use. **Dept P, Gus J Schaffner Co, Schaffner Bldg, Emsworth, Pittsburgh 2, Pa.**

Fire Extinguisher

STOP-FIRE HAND EXTINGUISHER combines carbon tetrachloride with carbon dioxide to produce a discharge without hand pumping. A gage attached to container indicates fluid pressure, and a hose attachment provides operating flexibility. **Dept P, Union Stop-Fire Corp, 30 4th Ave, Brooklyn, N. Y.**

Soot Remover

CHEMICALLY-PROPORTIONED SOOT REMOVER is reputed to (1) lower ignition point of caked and loose soot to permit burning (2) supply ample oxygen to support combustion. *O'Burnit*, made of six proportioned chemicals, is supplied with a feeder for lots of 1000 lb or more. **Dept P, O'Brien Industries, Bala-Cynwyd, Pa.**

Thermal Cutout

A THERMAL CUTOUT SWITCH DESIGNED to cut machines or appliances and remain inoperative until reset, this instrument is mica insulated, pile constructed, and corrosion protected. This unit, *Type RM ULA-SNAP*, will cut out at any predetermined temperature and can be reset by pushing a simple fiber button. *ULA-SNAP* is rated at 1,500 watts, 110-220 v,

Type DA-31 Pressure Control

MERCURY SWITCH
Hermetically sealed mercury switch is used. They cannot be affected by dust, dirt or corrosion; nor are they subject to open arcing, oxidation, pitting or sticking of contacts all common causes of contact trouble. This switch will give better control service and longer control life.

BOURDON TUBE
(Hidden back of cover)
The Bourdon tube is the actuating element of the control. It is the oldest known, tried and proven element, having been used in gauges for many years.

OUTSIDE ADJUSTMENT
The outside double adjustment with the calibrated dial and pointers is a convenient feature, making it very easy to set the required operating range, plainly visible on the dial. All guesswork is eliminated.

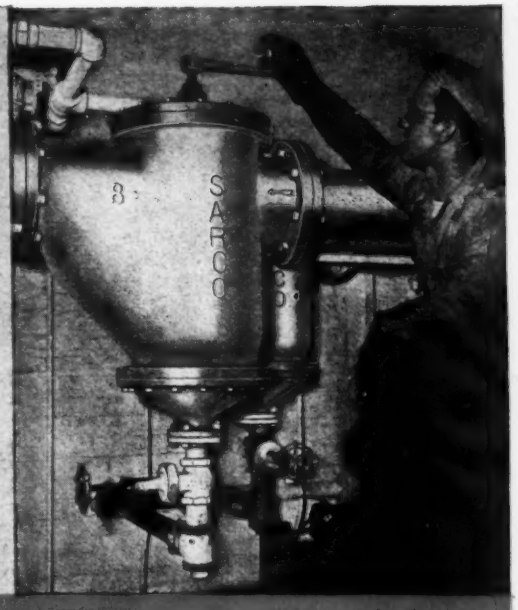
GLASS FACE
The glass face on the cover permits seeing the entire operation of the control in plain view. One can always tell whether the switch circuit is open or closed, a great convenience whenever servicing becomes necessary.

Consult Mercoid on pressure, temperature, liquid level or automatic mechanical control problems.

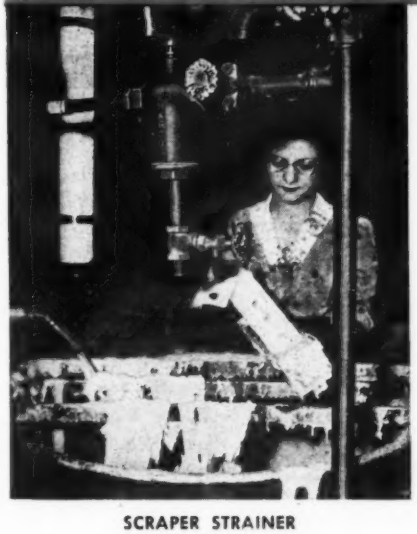
THE MERCOID CORPORATION
4201 Belmont Avenue
Chicago 41, Illinois

THE ASSURANCE OF DEPENDABLE SERVICE BUILT IN EVERY MERCOID CONTROL

Saved a Day— EVERY DAY *with*



SARCO SCRAPER STRAINERS



SCRAPER STRAINER
ON HOT WAX LINE

STANDARD STRAINERS
ON CIRCULATING PUMPS

Exhaust steam from twenty large steam hammers is worth saving. In fact, a large section of this Cleveland Metal Working plant is heated by reducing the exhaust to 6 pounds and running it to unit heaters.

But lint and other foreign material clogged the unit heaters and even the large steam lines. For years one man spent a day every day cleaning out the system.

Now the screens on the 8" Sarco Scraper Strainers shown are cleaned by a few turns of the handles—every morning. In addition to saving time, the heating system now operates at top efficiency at all times.

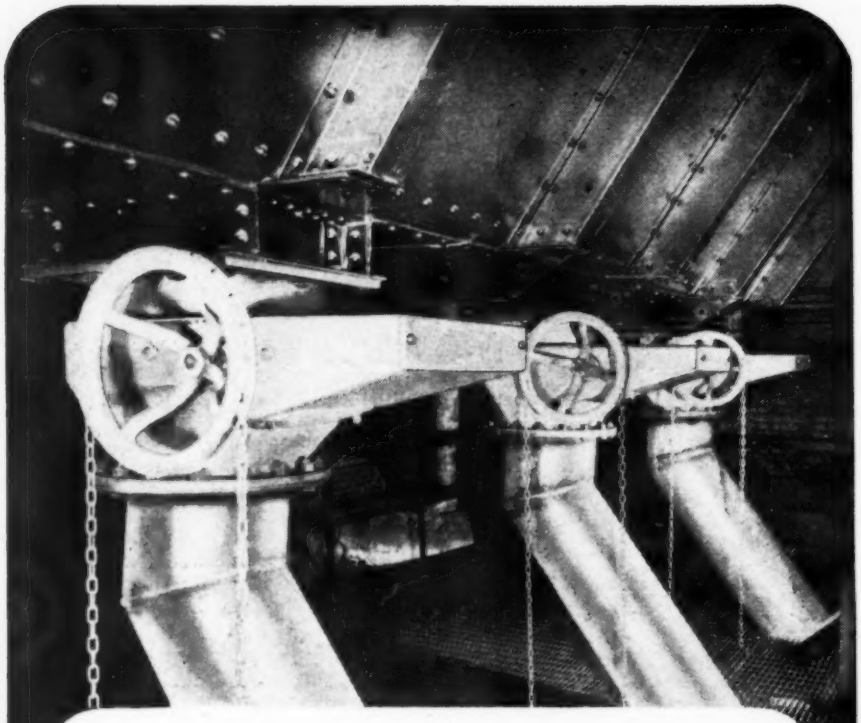
Sarco Strainers are equally satisfactory for oil, hot wax, varnish, water, chemicals, fruit juices, etc. Available in sizes from ¾" to 8" and 200 pounds. Ask for Catalogs Nos. 1200 and 1225.

SCRAPER
STRAINER

131

SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
475 FIFTH AVE., NEW YORK 17, N. Y.
SARCO CANADA, LTD., TORONTO 1, ONTARIO



BOTHERED BY COAL DUST?

Bottle it up with S.E.Co. Coal Valves

For startling evidence of the amount of coal dust created by coal—take any glass bottle, fill it a third full of coal when it's dry, cork the bottle tightly and shake it. The dust that will immediately cloud the bottle is only a slight indication of what happens when coal passes through your coal feeding system . . . and, unless tight "Bunker-to-Pulverizer" or "Bunker-to-Stoker" equipment is used, quantities of that dust will spread throughout your plant.

This dust nuisance and resultant bad effects can be avoided by using S. E. Co. dust-tight Coal Valves! These valves were designed with an eye to keeping dust where it belongs—*inside the valve!* This is achieved by means of a unique "sealed" construction, that literally bottles up the dust.

Full details on S. E. Co. dust-tight Coal Valves—descriptive data, engineering drawings, etc.—will be sent on request. Address STOCK ENGINEERING COMPANY, 715 Hanna Bldg., Cleveland 15, Ohio.

Try this convincing "Bottle Test".

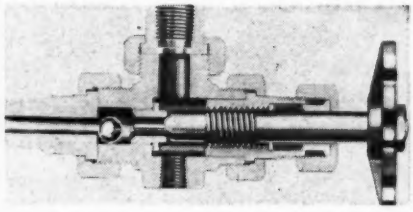
1. Partly fill any small bottle with dry coal.
2. Cork the bottle tightly and shake it.
3. Brother, the dust you see in that bottle is only a fraction of that produced by open coal feeding methods.

STOCK ENGINEERING CO.

★ CONICAL Non-Segregating Coal Distributors ★

S.E.CO. Coal Valves and Coal Scales

ac, and operates at temperatures ranging from 0-150 F, 0-300 F, and 0-700 F. **Dept P, George Ulanet Co, 413 Market St, Newark 5, N. J.**



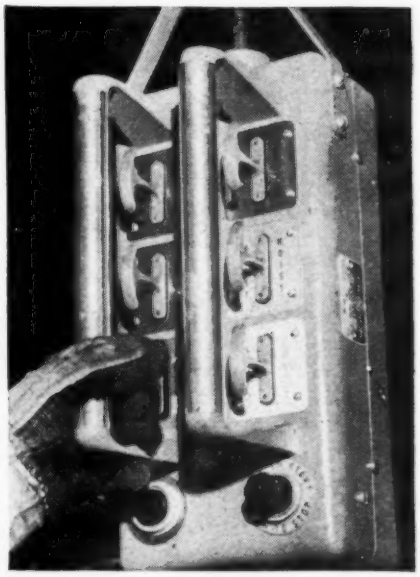
Sight-Gage Valve

NEW GAGE VALVE (No. 64) has a union connection to both sight gage and vessel that makes it possible to remove gage for inspection or maintenance without disconnecting valves. Union connections make it a simple matter to close valve and remove gage while process continues in operation. **Dept P, Jerguson Gage & Valve Co, Somerville 45 Mass.**

Time Clock

NEW TIME CLOCK with astronomic dial automatically turns lights or other equipment on at sunset and off at sunrise throughout the year. Dial has a calendar wheel showing month and day as well as time when switch will operate.

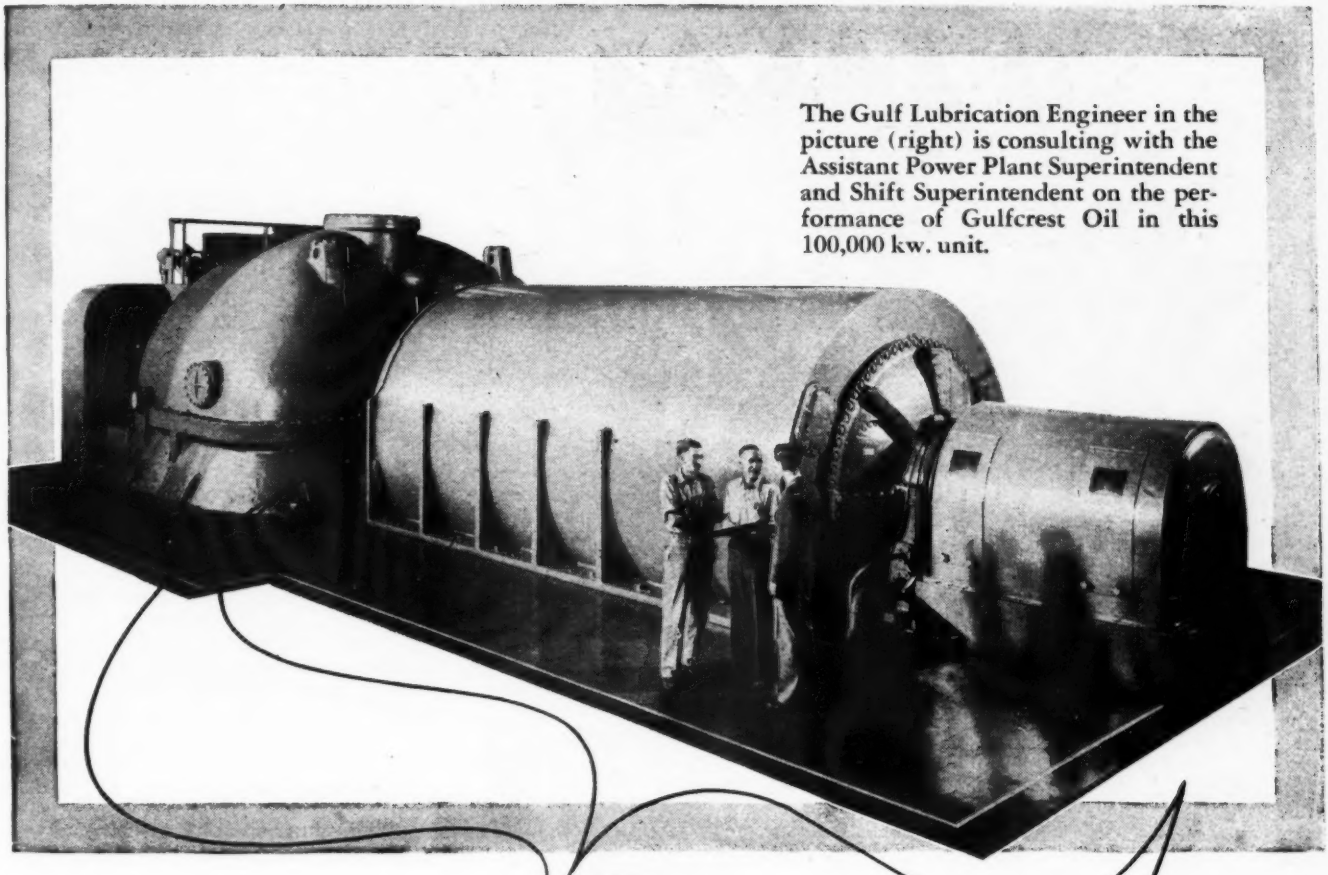
Clocks are self-starting synchronous-motor-driven with beryllium-copper blades and silver-alloy contacts. **Dept P, Tork Clock Co, Mt. Vernon, N. Y.**



Crane Control

PENDANT PULL-STATION CONTROL is designed specifically for floor-operated cranes using either ac or dc motors up to 15 hp, at 220 v. Control fits cranes ranging in size from simple hoists to 3-motion bridges.

An emergency stopbutton instantly cuts off power from all crane motors and operation cannot be resumed until this button is manually restored to the on position and momentary-contact reset button depressed. *Pendant* weighs only 8½ lb



The Gulf Lubrication Engineer in the picture (right) is consulting with the Assistant Power Plant Superintendent and Shift Superintendent on the performance of Gulfcrest Oil in this 100,000 kw. unit.

GULFCREST OIL

provides safe, sure, efficient lubrication for another big turbine—100,000 kw.

ANOTHER MODERN POWER PLANT insures its big investment by lubricating with Gulfcrest, the world's finest turbine oil!

And, after 21,000 hours of service in this 100,000 kw. unit, Gulfcrest Oil is again demonstrating its unmatched performance and long life. Neutralization number: 0.015. Make-up: 20 gallons per month.

Extra refining makes the difference! After the carefully selected crude oil used in Gulfcrest goes through the major refinery methods, it is then superrefined by the Alchlor Process.

More than 15 per cent of the oil is discarded by the Alchlor Process—this 15 per cent contains the hydrocarbons most apt to oxidize and form sludge, emulsifiers, and harmful acids.

That's why Gulfcrest is incomparably pure—why it gives outstanding performance, and lasts indefinitely. Send the coupon below for a booklet which gives you the complete facts on this superior oil.

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3800 Gulf Building, Pittsburgh 30, Pa.

Please send me, without obligation, a copy of your new booklet "Gulfcrest Oil for Steam Turbine Lubrication."

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Stop "Old Man Silica"!

...with De-ionized Water for your boiler feed

ILLCO-WAY It's easy to eliminate silica from your list of boiler feed troubles! ILLCO-WAY De-ionizers *now remove silica by ion exchange.* Silica in feed water for high-pressure systems is reduced to less than .5 ppm!

ILLCO-WAY With this same equipment you prevent boiler scale, corrosion, and embrittlement—because De-ionized Water is free from dissolved solids. ILLCO-WAY De-ionizers will produce thousands of gallons of silica-free water for only a few cents.

ILLCO-WAY Investigate this new process that keeps your boilers clean by ion exchange. Long a pioneer in water treatment engineering, ILLCO-WAY now offers the new scientific way of De-ionizing to "Stop Old Man Silica." Write for literature today.

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TESTED IN THE LABORATORY
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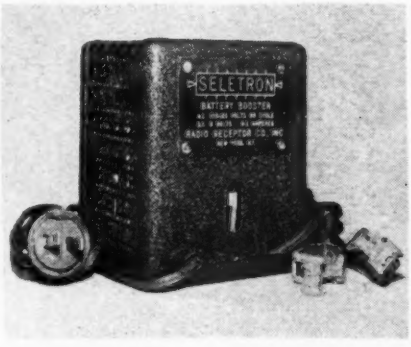
PROVED IN THE FIELD

Boiler Feed-Water Treatment

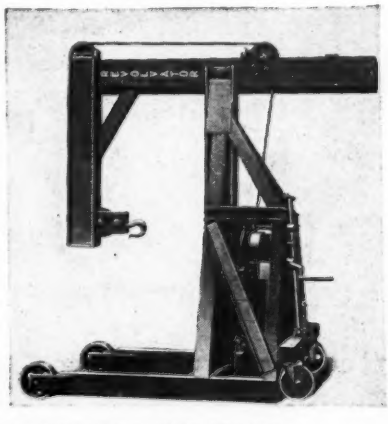
Complete equipment for Chemical Processing: Purification of industrial wastes, Separation of Chemical Solutions, Purification of Chemical Solutions, Reclamation of Valuable Constituents.

and may be suspended from crane trolley to hang beside load or hung at a distance. **Dept P, General Electric Co, Schenectady, N.Y.**



Battery Charger

COMPACT, LIGHT WEIGHT, automatic, constant-voltage battery charger is especially adapted for industrial plants using single 6-v storage batteries. Rated at 4-2 amp, this *Seletron* battery booster actually supplies 5 amp for a short period of time. *Seletron* is completely automatic and operates entirely without expendable parts and delivers correct trickle charge at all times. Long life selenium rectifiers and automatic circuit breaker assure constant output voltage and provide overload protection. Extremely compact, this unit takes up little space and weighs only about 4 lb. It operates on 105-120 v, ac 60-cycle and puts out 4-2 amp at 6 v, dc. **Dept P, Radio Receptor Co, 251 W 19th St, New York 11, N. Y.**

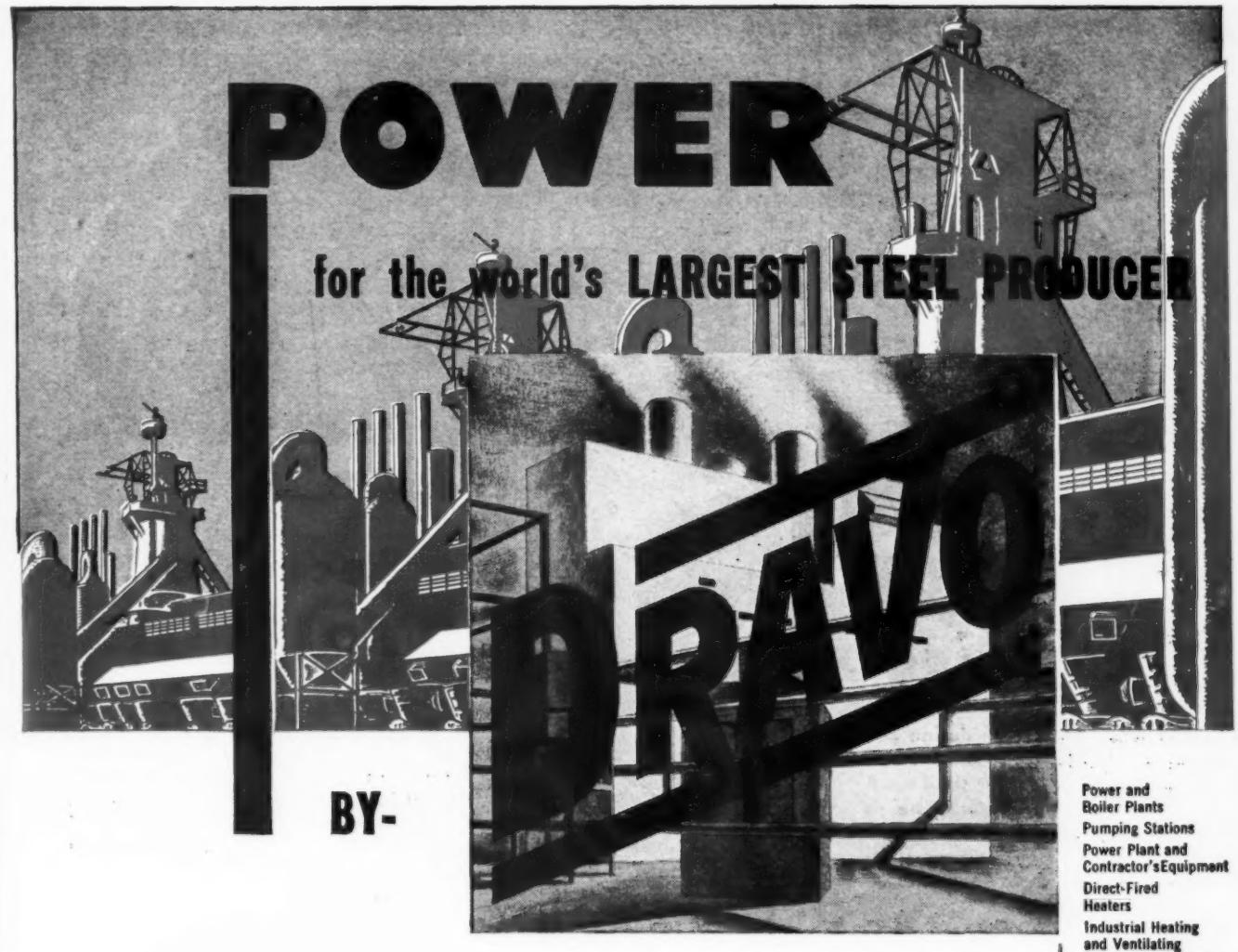


Folding Portable Crane

PORTABLE CRANE'S upper part can be folded down, which permits moving it under low doorways and overhead obstructions. Folding is done by hoisting crank and cable. To put crane in hoisting position, wind cable on drum until crane assumes upright position and lock it there by inserting pin through stationary and movable frame. To lower crane, raise hook to top, place interchangeable crankshaft or brake shaft, remove locking pin and lower crane to folded position. Crane has low gear for lifting heavy load, and high gear for light loads. Maximum capacity is 4000 lb. Crane has floor lock and steering-handle geared to front wheels, which turn easily on roller bearings. **Dept P, Revolvator Co, North Bergen, N. J.**

POWER

for the world's LARGEST STEEL PRODUCER



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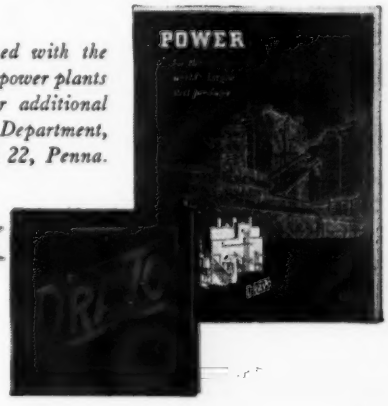
- Crane Cab Coolers
- Open Steel Flooring
- Concrete Aggregates
- Inland River Transportation

TYPICAL example of the results which you, as a purchaser and operator of power plants, can expect from the application of the DRAVO *Single-Contract Method* of Power Plant Construction is this installation for the Edgar Thomson Works of Carnegie-Illinois Steel Corporation.

☆ The need was urgent, the construction complicated. To relieve its own engineering staff of additional burdens of supervising and coordinating many sub-contracts, Carnegie-Illinois Steel Corporation, acting through Defense Plant Corporation, and the Consulting Engineers decided to place major responsibility with a single contractor.

☆ With more than a half century of experience in the construction of boiler and power plants and the installation of equipment, DRAVO was prepared to accept this responsibility. Under the DRAVO *Single-Contract Method* a definite price and a definite schedule for construction were assured. The reliance on DRAVO experience and responsibility produced tangible results when the construction schedule was maintained to completion and major equipment was put into service approximately six months before the completion date.

Industrialists and Engineers concerned with the construction and operation of boiler and power plants will want to read Bulletin AU-513 for additional details of the success of this project. Power Department, DRAVO CORPORATION, Pittsburgh 22, Penna.



Built by the Machinery Division with Substructure by The Contracting Division

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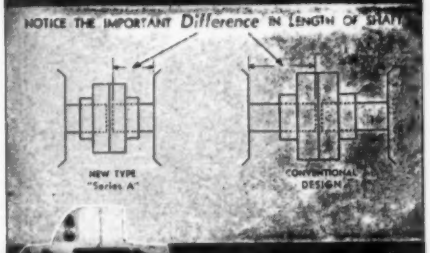
No Wonder This New Coupling Design Has Made A Hit With Coupling Buyers



THEY WANT THE ADVANTAGES OF THIS NEW

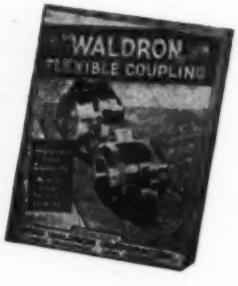
WALDRON

Gear Type *Series "A"* **COUPLING**

The new "Series A" design provides a much larger maximum bore to permit use of smaller sized couplings than would ordinarily be required. This advanced design takes up less space, needs less shaft extension—makes more compact installations.

It embodies all Waldron construction refinements. An all steel coupling that compensates for misalignment without adding stress to shaft or bearings.

Write For This **NEW** *Catalog*



Catalog 57 contains full details and rating tables on following types: Standard, Heavy Duty, Mill Motor, Marine, Floating Shaft, Jordan, Shear Pin, Oil Collector, Cut Out. Write today.

COUPLING DIVISION

JOHN WALDRON

CORPORATION

New Brunswick, N. J.

Sales Representatives in Principal Cities

The Secret of DART UNION Superiority

Bronze seats precision-ground to meet in a true ball joint insure a drop-tight connection without heavy wrenching. Uninjured in fitting, Dart Unions may be uncoupled easily—used over and over again. Bodies and nuts are made of high-test air-refined malleable iron—are practically indestructible.

Ask your supplier to demonstrate Dart's unique money-saving features.

DART UNIONS

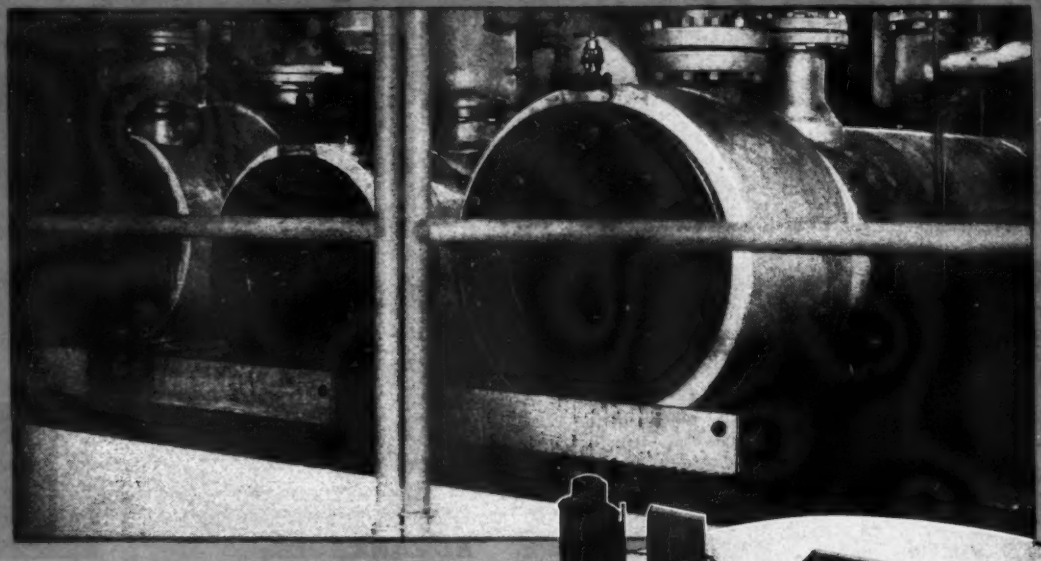
E. M. DART MFG. COMPANY

PROVIDENCE 5, RHODE ISLAND

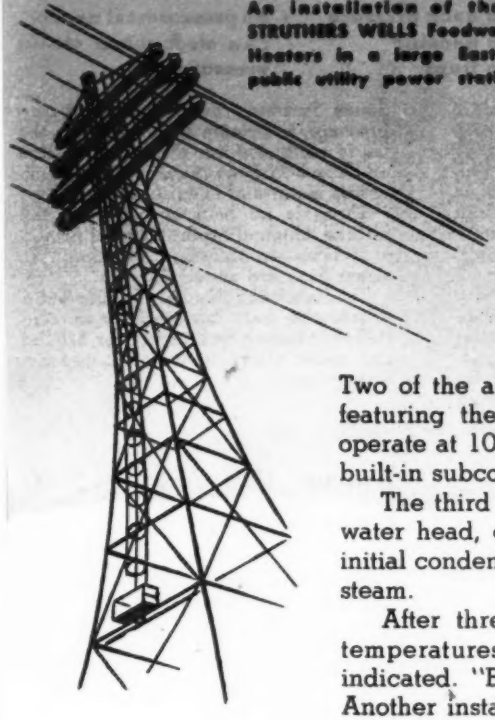
SW STRUTHERS WELLS

Feedwater HEATERS

FOR HIGH PRESSURE SERVICE



An installation of three STRUTHERS WELLS Feedwater Heaters in a large Eastern public utility power station.



Two of the above FEEDWATER HEATERS are high pressure units, featuring the STRUTHERS WELLS' "Boltless Head" closure, and operate at 1000 lbs. pressure One of these heaters also includes a built-in subcooling section.

The third unit is a low pressure heater with conventional bolted water head, employing a steam distribution belt to afford sufficient initial condensing surface to most effectively handle the low pressure steam.

After three years of constant service without cleaning, outlet temperatures had only dropped a few degrees, cleaning was indicated. "Boltless Head" closures have been proven trouble-free. Another installation is now being made for the same company at a new plant.

Write for descriptive, technical Bulletin No. B-17.

STRUTHERS WELLS CORPORATION

Process Equipment Division

WARREN, PENNA.

PLANTS AT WARREN, PENNA. AND TITUSVILLE, PENNA.

Improving Heat Transfer Of Lube Oil Coolers

WHEN even a one-sixteenth inch coating of foreign matter forms on cooler coils, it materially affects engine performance through inefficient heat transfer. Periodic desludging with recommended Oakite alkaline type materials is your best bet to keep lubricating oil at proper temperatures.

THEN to keep coils of your evaporative coolers free from scale and slime, introduce recommended solution of specialized Oakite material into make-up water. Special properties of this Oakite Compound control slime and effectively help prevent lime-scale from depositing on coils . . . from clogging spray jets. Make-up water treated the Oakite way will help maintain peak cooling capacity by preserving normal heat transfer efficiency.

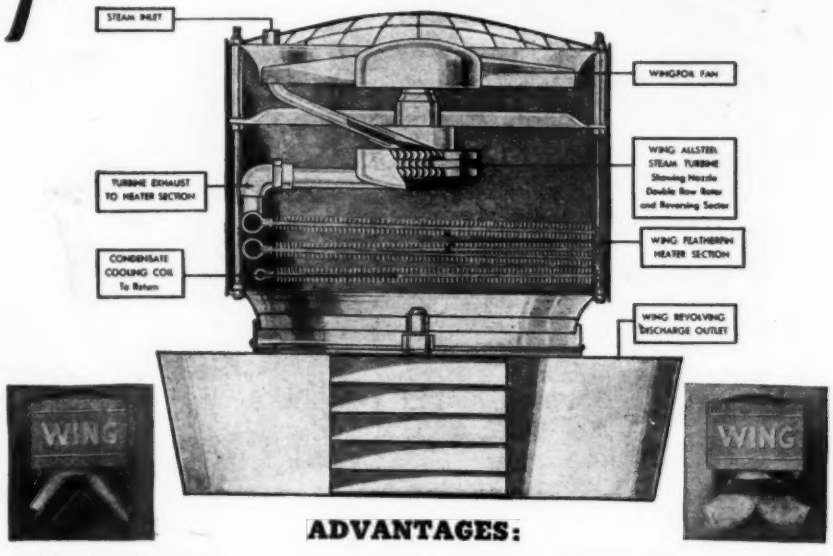
A NFARBY Oakite Technical Service Representative will gladly help check the condition of your equipment . . . recommend the most economical material and method to restore units to peak operating efficiency. Call him today! Or send for FREE, 4-page Service Report giving complete, technical details. No obligation either way.

OAKITE PRODUCTS, INC.
23 Thames Street, NEW YORK 6, N. Y.
Technical Representatives in Principal Cities of U.S. & Canada

OAKITE

Specialized Industrial Cleaning
MATERIALS • METHODS • SERVICE

Another WING "First"!
the Wing Turbine Revolving Unit Heater


STEAM INLET
WINGFOIL FAN
WING ALLSTEEL STEAM TURBINE Shrouding Nozzle Double Row Rotor and Reversing Sector
TURBINE EXHAUST TO HEATER SECTION
WING FEATHERFIN HEATER SECTION
CONDENSATE COOLING COIL To Return
WING REVOLVING DISCHARGE OUTLET
WING
WING

ADVANTAGES:

- **No electric motor**
- **Source of heat is also source of power**
- **No back pressure**
- **No packing**
- **No traps**
- **No pressurestat needed. Fan stops when steam pressure stops**

This new product is the logical result of constant improvements in two specialized lines of equipment pioneered by L. J. Wing Mfg. Co.

The first Wing turbine was built as an integral part of the Wing forced draft blower 40 years ago. The first lightweight-suspended downward-discharge unit heater was introduced by Wing 25 years ago. The patented revolving discharge outlet was introduced in 1935. The Wing Turbine Driven Revolving Unit Heater, now offered, combines all three.

Powered by the new Wing Allsteel Steam Turbine which operates at *any* pressure, the steam which propels the fan is exhausted into the heater section and used to heat the air—thus eliminating motor and electric power.

There is no back pressure on the turbine, eliminating the need of power-absorbing, troublesome packing. No steam traps are used.

The Revolving Discharge Outlets distribute the heat continuously in constantly changing directions, over, around and under obstructions, into out-of-the-way corners.

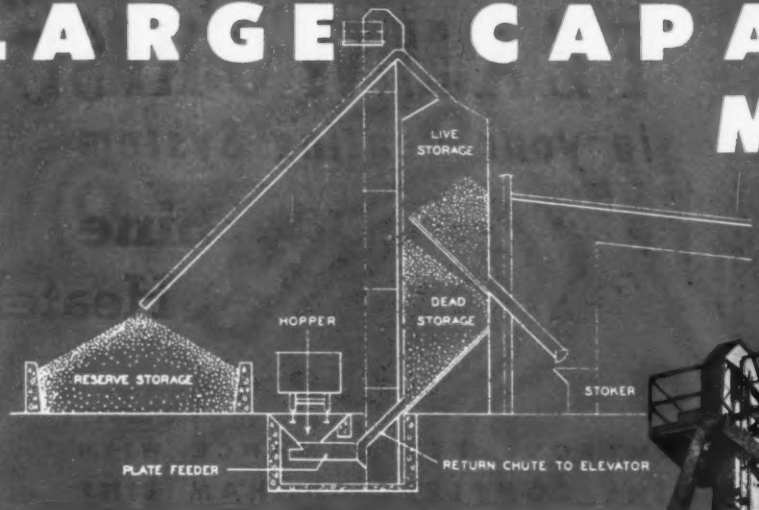
Write for Bulletin

L. J. Wing Mfg. Co. 50 Seventh Avenue, New York 11, N. Y.

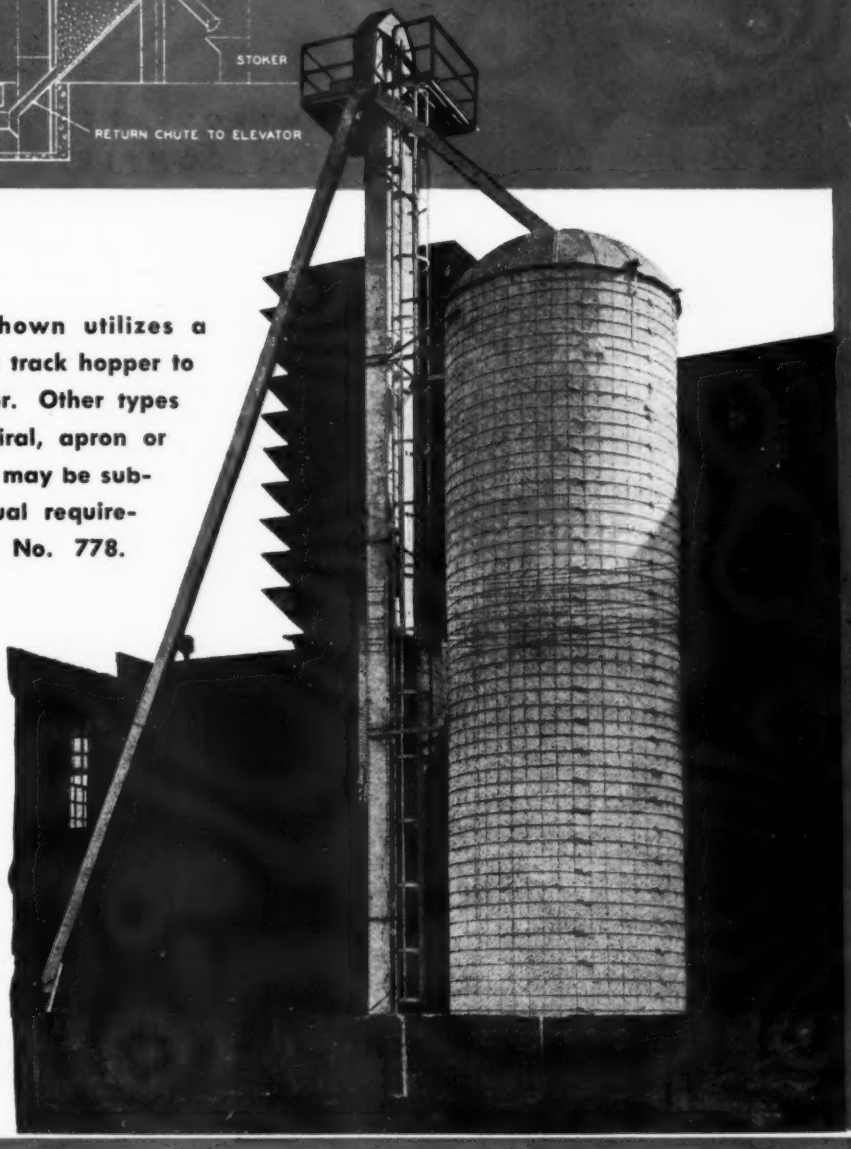
Factories: Newark, N. J. and Montreal, Canada

Wing

LARGE CAPACITIES MINIMUM SPACE



Arrangement shown utilizes a plate feeder from track hopper to the bucket elevator. Other types of feeders . . . spiral, apron or electric vibrating . . . may be substituted to fit individual requirements . . . Catalog No. 778.



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THE JEFFREY MANUFACTURING COMPANY

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Complete Line of Material Handling, Processing and Mining Equipment

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Make Your Overhead Valves SAFE and Easy to Reach---

With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

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New Bedford, Mass.

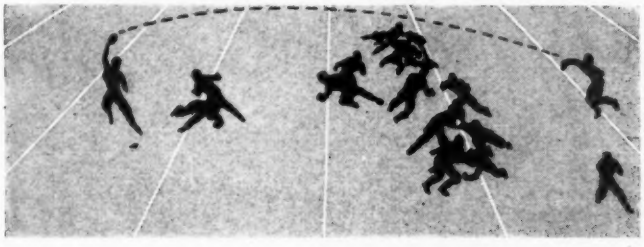
REDUCE MAINTENANCE TIME—INCREASE PLANT EFFICIENCY

Whether it's loosening a frozen part, nut, bolt or cleaning gummed-up machinery and tools... maintenance time steals profits. Let Tasgon do the tough jobs for you. Tasgon is the *quickest and most penetrating rust solvent on the market.* A few drops of Tasgon will almost instantly cut through rust ... free frozen parts...save hours of labor.

See For Yourself. Write for free sample TODAY! Samuel Cabot, Inc. 1605 Oliver Bldg., Boston 9, Mass.

TASGON

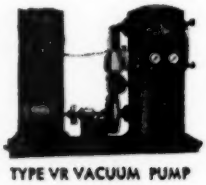
For better "TEAMWORK" *in your Heating System*



IMPROVE PERFORMANCE WITH THE COMPLETE DUNHAM LINE

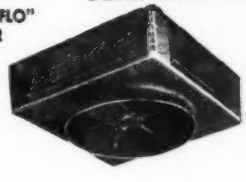
Eliminate costly weak spots in your heating system ... with one manufacturer having the responsibility for successful operation of equipment — let Dunham valves, traps, pumps, unit heaters and/or convectors give you renewed efficiency and economy of operation. A *complete* line covering a range of low pressure and atmospheric steam heating specialties. If "Better heating" is your goal, find out how Dunham precision engineered products will help you achieve it. Write for bulletin 634J. C. A. DUNHAM CO., 450 E. Ohio St., Chicago 11, Ill.

TYPE FCF CABINET CONVECTOR


TYPE VR VACUUM PUMP

TYPE WCF CABINET CONVECTOR

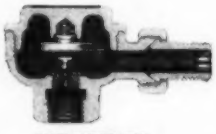
TYPE C "DOWNFLO" UNIT HEATER



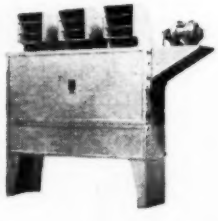
THERMOSTATIC FLOAT TRAP

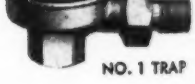
NO. 1140 PACKLESS VALVE

TYPE V UNIT


THERMOSTATIC STEAM TRAP

TYPE R UNIT HEATER

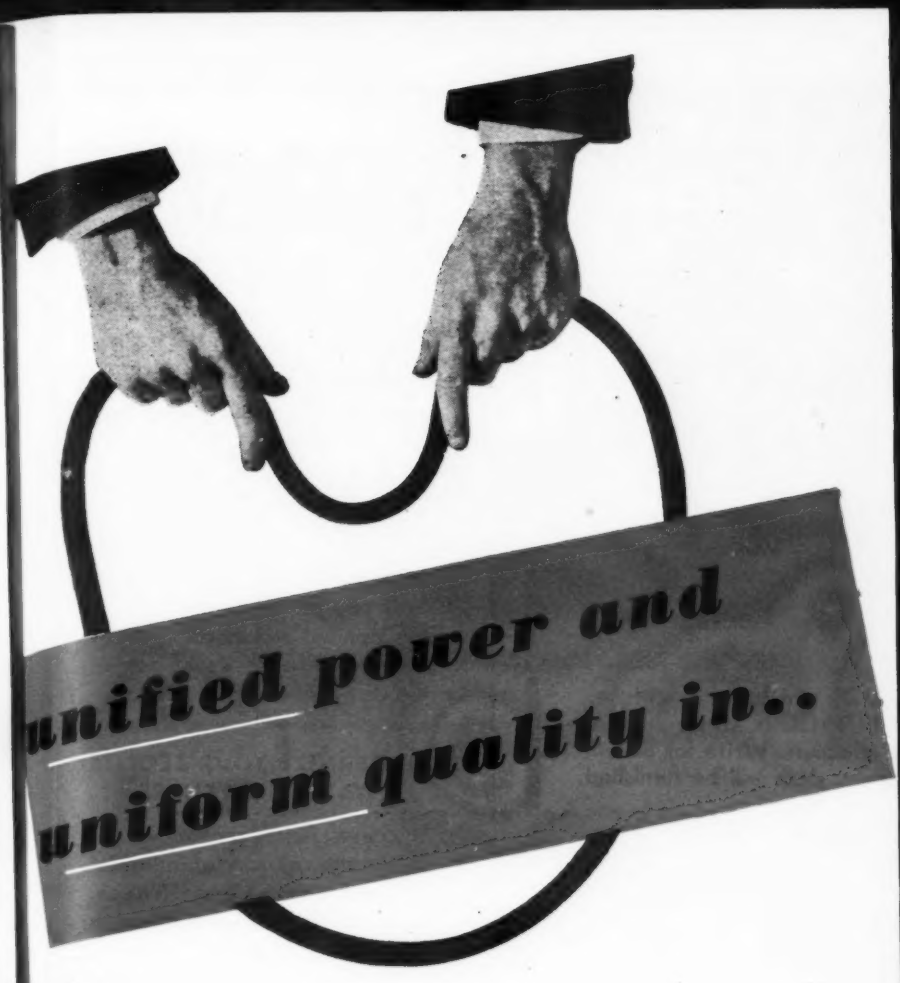



NO. 1 TRAP

DUNHAM

HEATING MEANS BETTER HEATING

247B



MANHATTAN'S
Condor WHIPCORD V-BELTS

In a team of Condor Whipcord V-Belts there are no laggards to kill the load pullers. The inelastic stretch left in a Condor V-Belt after manufacture is negligible. The stout Whipcords that comprise the Strength Members of a Condor V-Belt are "laid to stay" in their firm matrix of Flexlastics.

Flexing can be at high speeds and continuous on short centers without deterioration due to overheating. As the cross section shows, the Flexlastics surrounding the Whipcords afford an effective cushion against friction and are specially compounded to dissipate internal heat. Note the unusual flexibility of the Whipcord construction in the demonstration above.

This means better contact in the sheave grooves . . . steadier pulling with multiple belts of uniform quality.

Whether your drive is two belts or twenty, make sure you get all "pull" for your power costs by using CONDORS.

ACKNOWLEDGED ADVANTAGES

1. Wide margin of strength
2. Minimum inelastic stretch
3. Uniform flexibility
4. Maximum resistance to structural breakdown
5. Smooth running
6. Maximum traction
7. High resistance to side wear
8. Correct lateral reinforcement

The term FLEXLASTICS is an exclusive MANHATTAN trade mark. Only MANHATTAN can make FLEXLASTICS.

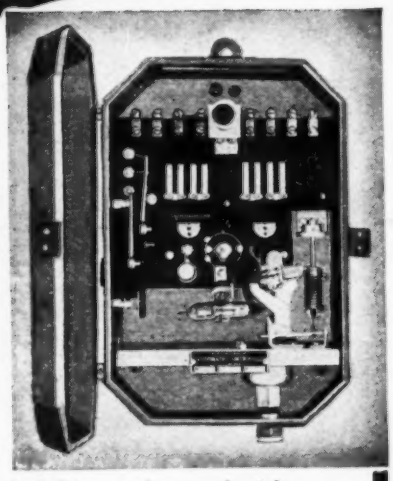
RAYBESTOS-MANHATTAN, INC.
MANHATTAN RUBBER DIVISION
EXECUTIVE OFFICES AND FACTORIES PASSAIC, NEW JERSEY

Prevent DRY PUMP OPERATION

with the New

AUTOMATIC CONTROL CO.

PROTECTROL



If your primary control calls for pump operation, and water is not discharged, —PROTECTROL stops the pump, locks out the starter until PROTECTROL is manually reset. It also rings alarm bell and lights warning signal. It prevents damage to bearings and excessive wear caused by running the pump dry. PROTECTROL can be used with any make of pump or automatic control. PROTECTROL is better than an insurance policy,—it prevents damage before it occurs. Write for Bulletin T-1130. State your requirements and engineering data will be furnished.

"AUTOMATIC" also makes pressure and float operated pump controls: multi-circuit sequence type, multi-circuit program type, float switches, automatic alternators, and many special controls built to specifications.

AUTOMATIC CONTROL Company

1009 University Ave., St. Paul 4, Minn.

AUTOMATIC CONTROLS are used by all leading pump manufacturers. When ordering new pumps, specify controls by AUTOMATIC CONTROL CO.

NO-KARB

CLEANS SOOT and FIRE SCALE WHILE BOILERS OPERATE

For high or low pressure boilers, coal or oil-fired.

Money-Back Guarantee with trial order.

Whether you use tube blowers or not, you will find No-Karb an invaluable aid in keeping boilers and tubes free from carbon, soot and fire-scale.

Simply toss a little No-Karb over the burning coals or in the path of the burning flame, and carbon or soot, chemically reduced to the ignition point of fuel, is consumed with the fuel.

Boiler efficiency is increased; time of cleaning boilers and tubes largely reduced.

NUTMEG CHEMICAL CO., 223 State St., New Haven 10, Conn.

LOW COST DEMINERALIZED WATER

WILL REPLACE EXPENSIVE DISTILLED WATER IN THE MAJORITY OF APPLICATIONS

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MODERNIZE YOUR ZEOLITE WATER SOFTENERS

The new Belco zeolite will increase the capacity of industrial softeners up to six times as much. Ideally suited for modernization of present equipment. Belco engineers are always available to help you.

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CHECK WITH BELCO...first!

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Eliminate DAMAGING WATER and OIL from Your Compressed Air Lines

WITH

ADAMS AFTERCOOLERS and CYCLONE SEPARATORS

Air Cooled to Within 10 DEGREES of Cooling Water! EASILY INSTALLED! Pipeline Construction

ADAMS equipment insures a constant supply of cool, moisture-free, oil-free air to power your compressed air tools with the highest efficiency and safety . . . at the *lowest* installation and maintenance cost.

ADAMS AFTERCOOLERS are *guaranteed* to cool air to *within 10 degrees* of your cooling water. This means *extra* thoroughness in condensing water and oil vapors from your compressed air.

NO FOUNDATION or other facilities are required for installation. The Adams "pipeline" construction permits the After-cooler and Cyclone Separator to fit right into a section of the pipe line . . . either vertically or horizontally!

CYCLONIC SEPARATION is the Adams principle . . . engineers agree that it is *far more efficient* than other mechanical separation!

WRITE

today for full engineering data on improved pneumatic power performance. Ask for Bulletin 703.

R. P. ADAMS CO., INC.

67 Chicago St., Buffalo, N. Y.

ADAMS AFTERCOOLERS and CYCLONE SEPARATORS

WeldELLS have everything

WIDEST RANGE
of types; sizes; thicknesses.
SEAMLESS
For greater strength
QUARTER-MARKED ENDS
Easier, more accurate fabrication.
FULL WALL THICKNESS
Never less than specification minimum.
REINFORCED HERE
More metal where the stress is higher.
MACHINE TOOL BEVEL
Best welding surface. Accurate bevel and land.
TANGENTS
Keep weld away from highest stress zone; simplify lining up.
PERMANENT IDENTIFICATION
You can't go wrong on size and weight.

DOWN to the last detail WeldELLS are engineered to meet *all* requirements of *any* pipe welding job. They measure up to *all* requirements of pipe welding more fully than other fittings because they have designed into them features that are combined in no other make.

A number of these features are pointed out above. They give you the means of doing the job as *well* as it can be done —as easily, as rapidly, as economically as it can be done. This combination of features means extra value that is yours only in WeldELLS and other Taylor Forge fittings for pipe welding. Insist on the fittings that *"have everything"* . . . it pays!

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BECAUSE THEY'RE SMALL, BUT POWERFUL, AND GO ANYWHERE

For a small, tough, hard-working turbine that will go anywhere and do all you expect of it . . . get a Coppus "Blue Ribbon" Steam Turbine.

Coppus Steam Turbines come in six frame sizes from 150 HP down to fractional—so you can match more closely your job requirements. Each smaller size is priced correspondingly less, so by selecting "horsepower" instead of "elephant power" you save on investment and installation cost.

Many well-known manufacturers install Coppus "Blue Ribbon" Steam Turbines on original equipment. They know Coppus quality will protect the reputation of their own products. The Coppus Turbine is also being used on many U. S. Destroyer Escorts, all Casablanca class aircraft carriers and 90% of all Landing Ship Docks.

Like all Coppus "Blue Ribbon" products (blowers, ventilators, gas burners, etc.), the Coppus Steam Turbine is a precision-made product, with accuracy controlled by Johansson size blocks. Every turbine is dynamometer-tested before shipment.

More than 85% of all orders since 1937 have been repeat orders.

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"BLUE RIBBON" PRODUCT

Write for Bulletin 135-9. Coppus Engineering Corporation, 162 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" Products in SWEET'S, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

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SPEED INDICATORS and HAND TACHOMETERS

Measure rpm without timing or calculation while held against end of rotating shaft. Any variation in speed caused by belt slipping, overload, etc., is instantly noted. Also have disc for measuring surface speeds in feet per min. Made for speeds from 30 to 12000 changing speed range by new rotating shift mechanism. Other types to 48 000 rpm. Write for details.

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PRECISION TOOL HANDBOOK

Almost a hundred pages of profusely illustrated data on precision tools of all kinds—1/10,000" micrometers, calipers, height gages, dial indicators, optical equipment, magnifiers, projectors; laboratory instruments; metallurgical equipment; revolution counters; and many other items. Your request brings a copy. Write.

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IMO—The PUMP for SMOOTH FLUID FLOW

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For information send for catalog I-133-P

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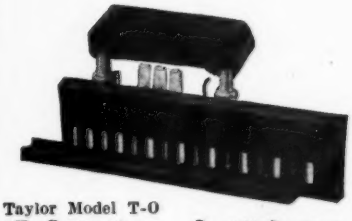
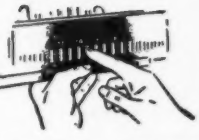
Keep BOILER OUTPUT HIGH!



Taylor Model T-O pH Comparator—basic outfit of the Taylor line. All pH slides and many others can be used with this one base.



CHECK YOUR BOILER WATER WITH TAYLOR COMPARATORS

With Taylor Comparators, you may now quickly and easily determine phosphates, pH, nitrates, silica . . . and many other factors which affect steam costs. Check pH and chlorine accurately in sixty seconds . . . most other residuals in less than two minutes. Simply place prepared sample in base, move slide containing color standards until match is obtained and read direct from values engraved on the slide. Each inexpensive outfit is light, durable and completely portable. All Taylor color standards carry an UNLIMITED GUARANTEE AGAINST FADING. The *Comparator you need is in this list:*

pH Comparators covering range 0.2 to 13.6
Long Range pH Comparator
Dalite pH Comparator
Boiler Water Comparator (pH and phosphate)
Water Analyzer
High and Low Phosphate Comparators
Poly Phosphate Comparator
Enslow Slide Chlorimeter
Nitrate Comparator

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88-page book gives applications to many types of power plant needs, illustrates and describes outfits which have proved their worth to men such as you . . . gives full details! See your dealer today, or write direct to:

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Gilmer

MULTIPLE V-BELTS
FOR POWER . . . . .
FOR PERFORMANCE

Gilmer Multiple V-Belts have a grip like a friction clutch. They take tight hold as they flex around sheaves. Yet they unlock freely the instant that pressure is released . . . the Gilmer principle of straight-wall design.

Precision molding provides "matched" lengths to within very small tolerances. Pulling cords are conditioned to minimize stretch. And the tough, heavy jackets add extra months of dependable service.

Being made on the largest assortment of V-molds in the world, Gilmer V-Belts are supplied in all standard and many special sizes. When desired, belts are specially built to withstand conditions of excessive oil, heat, static, etc.

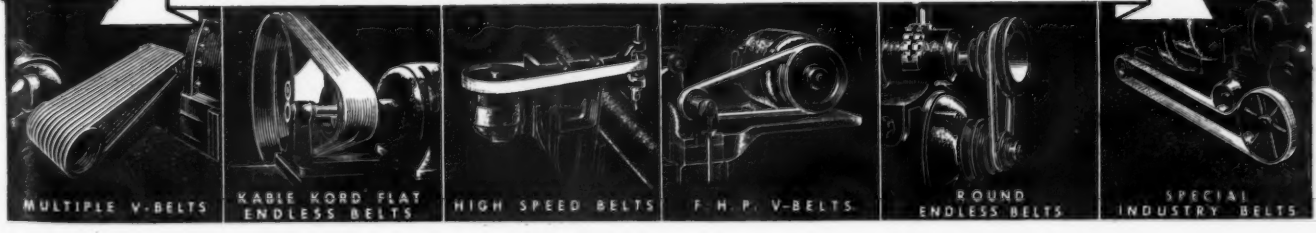
Your Gilmer Distributor is close at hand, ready to help you select the right belt for any drive. Write to us for a FREE copy of the Gilmer Guide, the most complete V-Belt catalog ever published.

L. H. GILMER COMPANY, Tacony, Phila. 35, Pa.
Division of United States Rubber Company

Gilmer BELTS

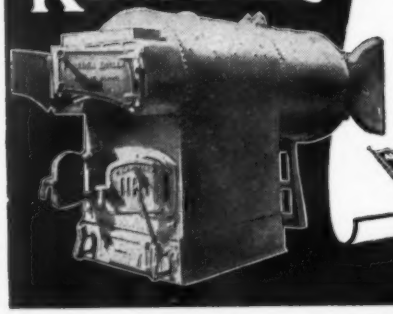
Get in touch with your Gilmer Distributor

THERE IS A GILMER POWER TRANSMISSION BELT FOR EVERY NEED



Extra STRENGTH for Heavy Duty

KEWANEE



● Backed by more than 75 years of boiler building experience Kewanee Heavy Duty types have all the characteristics which make firebox boilers ideal for high pressure.

10 to 304 H.P.
100, 125, 150 lbs. W. P.

Built of steel with extra stout stays and braces to add further strength.

For 6" Scale with pipe diameter markings . . . WRITE Dept. 96-K2

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Division of American Radiator & Standard Sanitary Corporation

COMING IN APRIL POWER—

A 16-page special section on Steam Condenser Systems

—covering fundamentals, types, construction, design, performance, selection, operation and maintenance. To make certain you receive this important operation and maintenance aid, subscribe now to:

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MULTOMETER SYSTEM CONTINUOUS BOILER BLOW-OFF

Weighs only 40 lbs.

"Accomplished all you claimed for it" . . . . . .

SAYS COLD STORAGE COMPANY

Heretofore it has always been necessary for us to scrape the blades of our steam turbine every year; but when this was recently opened for inspection, after a run of 15 months, it was found to be absolutely clean. Since no other change was made in equipment or operation, we may assume that the *Multometer Control* of boiler concentration eliminated wet steam and the carry-over of solids to connected equipment. This is further verified by greater efficiency in steam generation and a total increase in evaporative rate of nearly ½ pound of water per pound of coal.

Since the *Multometer System* was installed, we have gradually extended the time of boiler operation between wash-outs until this is now double the former period. Boiler blow-off has been reduced to only 2% of total feed water and is a definite, known factor instead of a blind guess.

Complete information upon request.

P. E. MADDEN & COMPANY
352 W. WALTON ST. CHICAGO 10, ILL.

LENGTHEN BOILER LIFE

Lessen Boiler Deterioration
More Power - Less Cost
Fewer Shut-Downs

Keep Heat Transfer Surfaces Clean - with

SAND-BANUM

It Automatically and Safely
REMOVES and PREVENTS

boiler scale and corrosion while your equipment operates.

This merely means that boilers can do more—do it longer—at less cost.

Sand-Banum comes ready to use as is; requires no special equipment, mixing or expert handling. Age, climate, water or operating conditions have no effect on its efficiency.

BE BOILER WISE

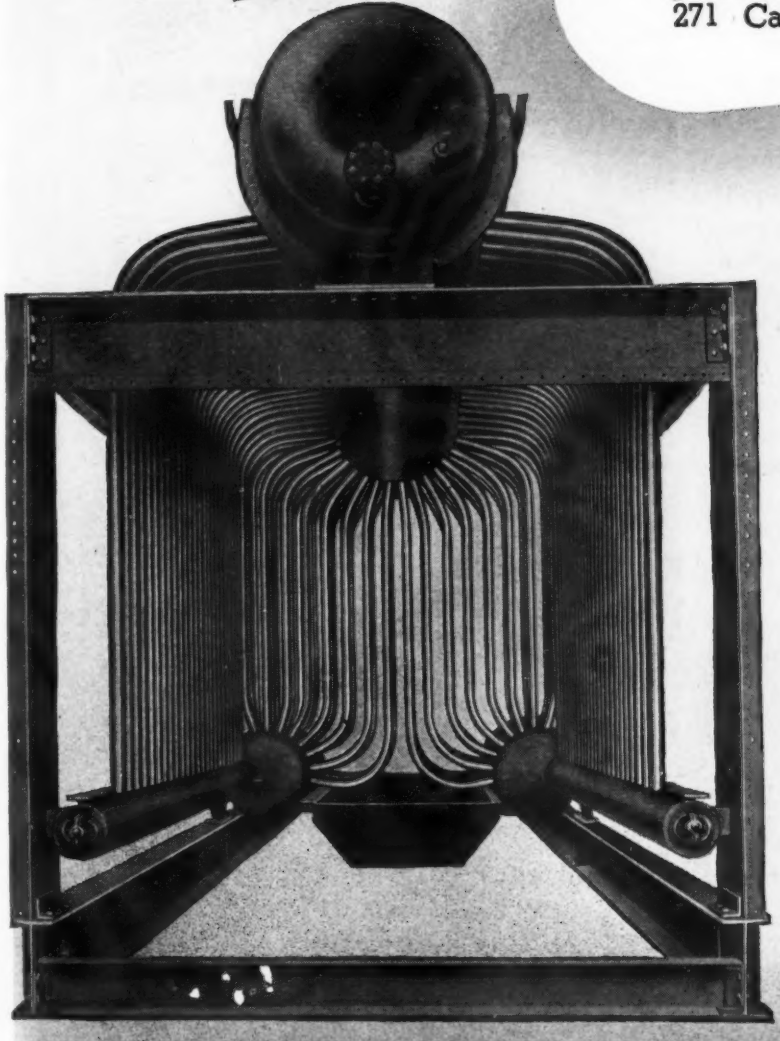
Write for Data Today.

AMERICAN SAND-BANUM COMPANY, Inc.
9 Rockefeller Plaza, New York 20, N. Y.

Stocks carried by
WESTERN SAND-BANUM COMPANY
Houston, Texas
and at other convenient points including
Leading supply houses
Export Representatives
PETROLEUM MACHINERY CORP.
30 Rockefeller Plaza New York 20, N. Y.

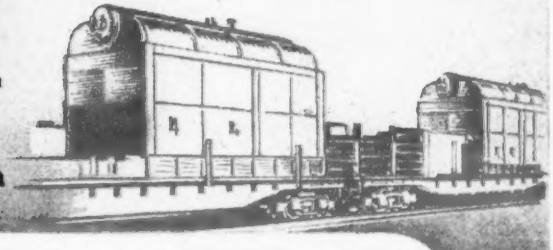
UNION OFFERS *New* BOOKLET ON *New* BOILER DESIGN

We have prepared a book illustrating the construction of our latest boiler development, the "S" type boiler. Complete engineering data is included. Request your copy of this booklet on company letterhead, please. Address Union Iron Works, 271 Cascade St., Erie, Pa.



The UNION "S" type boiler is a compact self-contained unit complete with water cooled furnace. It can be shipped fully assembled in sizes to 300 H. P. It has narrow overall width and large furnace volume in a low setting height, providing large capacity in limited space.

You will be interested in knowing how we have designed water wall circulation without circulator connections and in many other new features.



UNION IRON WORKS • ERIE, PA.

Since 1890

BOILERS — PROCESS EQUIPMENT — FABRICATED STEEL

Hones big diesel engine cylinder liners

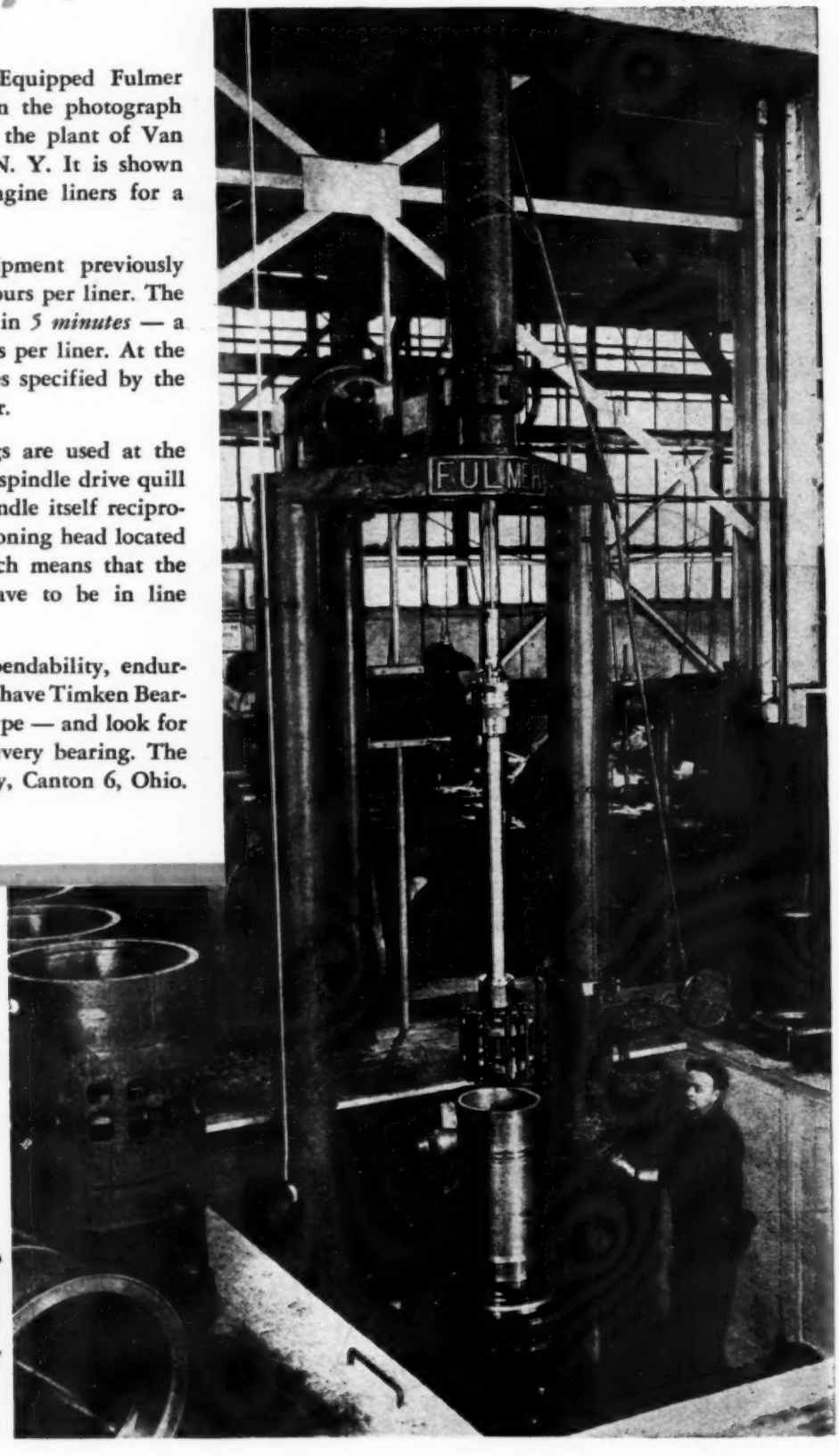
in five minutes

The Timken Bearing Equipped Fulmer Model 20/72 Honing Machine in the photograph is one of a battery operating in the plant of Van Der Horst Corporation, Olean, N. Y. It is shown honing chrome plated Diesel engine liners for a large locomotive builder.

With the type of honing equipment previously used, this operation required 2 hours per liner. The Fulmer Honing Machine does it in *5 minutes* — a clear saving of 1 hour 55 minutes per liner. At the same time the exacting tolerances specified by the user are maintained to the letter.

Timken Tapered Roller Bearings are used at the upper and lower positions of the spindle drive quill and on the pinion shaft. The spindle itself reciprocates through the quill and the honing head located below two universal joints, which means that the center of the liner does not have to be in line with the spindle proper.

For the utmost in accuracy, dependability, endurance, and economy make sure you have Timken Bearings in your equipment — any type — and look for the trade-mark "TIMKEN" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio.



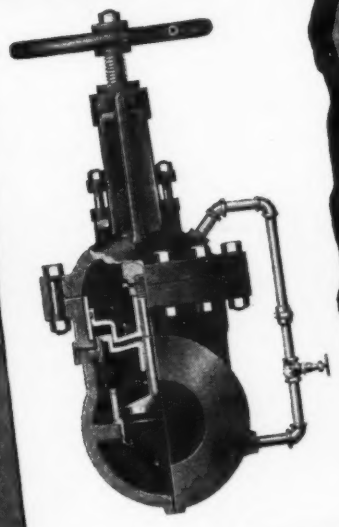
TIMKEN BEARING EQUIPPED

PHOTOGRAPH COURTESY VAN DER HORST CORPORATION.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

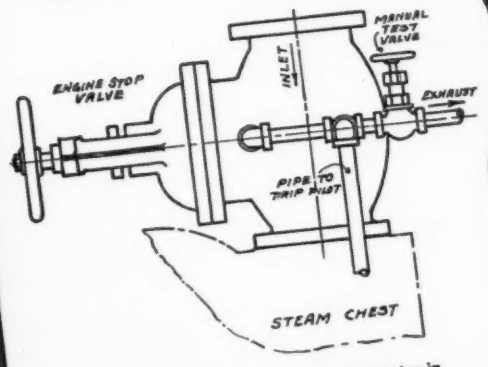


HOW TO AUTOMATICALLY PREVENT

TURBINE OR ENGINE OVERSPEEDING

install

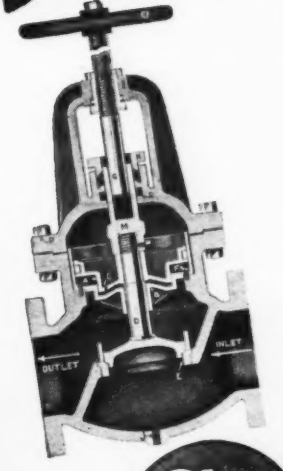
GOLDEN-ANDERSON THROTTLE and AUTOMATIC ENGINE STOP VALVES



Golden-Anderson Throttle-Engine Stop Valve in horizontal position with downward steam flow.

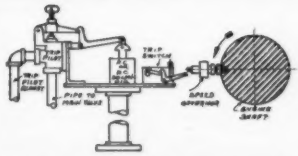
On overspeeding of engine or turbine the shaft governor may directly operate trip pilot control valve or limit switch, if solenoid trip pilot control is used, to open trip pilot control valve and permit engine stop valve to instantly close and stop engine or turbine.

By running down handwheel stem the valve may be closed any time, and by-pass valve should be closed when the valve is to be maintained in closed position over a period of time.

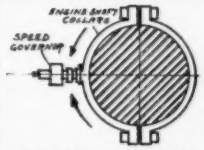


Free Engineering Aid...

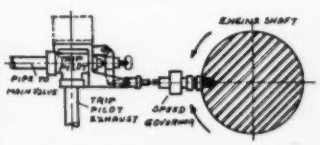
Let GOLDEN-ANDERSON engineers help you on any new or replacement valve problem.



Electric trip pilot and switch assembly with governor attached to engine shaft.



Governor mounted with split collars attached to engine shaft.



Mechanical trip pilot assembly with governor attached to engine shaft.

GA GOLDEN-ANDERSON Valve Specialty Company

KEENAN BUILDING · PITTSBURGH 22, PA.

WHY DAYTON V-BELTS *Eliminate Vibration*

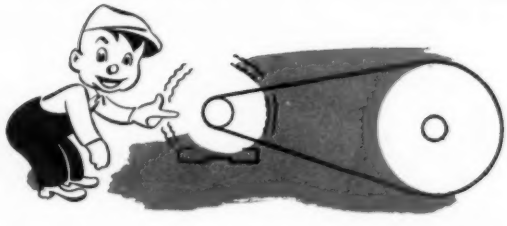
NO VIBRATION! NO BREAKDOWNS!
in 12 years of beating paper into pulp

In the plant of a large eastern boxboard mill, five huge beaters reduce old cardboard and corrugated paper into pulp. It's a rough, dusty, tough job. The first of these five beaters, installed over 12 years ago, was equipped with a drive that frequently broke due to excessive vibration and shock-starts and stops. Something had to be done. A Dayton V-Flat Drive was installed, using the original large flat pulley. Smooth starting and stopping and absence of vibration immediately put an end to breakdowns and reduced machine maintenance to a minimum. Naturally, as *new* beaters were installed they were all equipped with Dayton V-Belt Drives.

Dayton V-Belts eliminate vibration because their engineered resilience and the smooth, easy way they seat themselves in the pulley grooves absorbs any motor or machine vibration, or sudden jerks or jars caused by an uneven load condition. Elimination of vibration is one of many reasons why Dayton V-Belts can help you solve your power transmission drive problems efficiently and economically. Your Dayton Distributor will gladly tell you the full story. Call him today.

THE DAYTON RUBBER MANUFACTURING COMPANY
DAYTON 1, OHIO

Branch Offices: Atlanta • Boston • Chicago • Cleveland
Cincinnati • Dallas • Dayton • Detroit • Los Angeles
Minneapolis • New York • Philadelphia • St. Louis



The shocks of suddenly applied power are absorbed by Dayton V-Belts seating themselves further down in the pulley grooves. Any motor or machine vibration is absorbed by the engineered resilience of Dayton V-Belts.

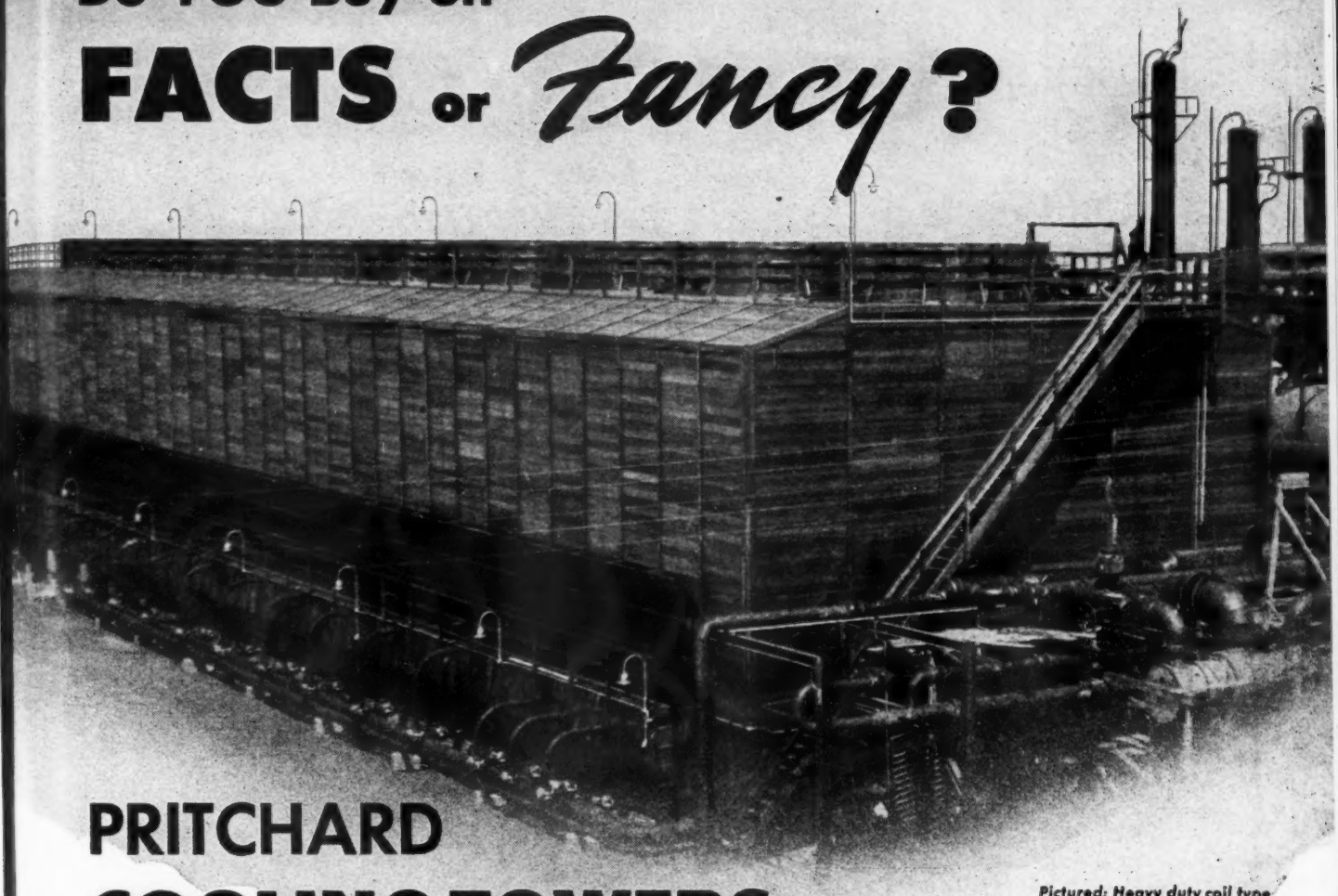
V-BELT BUYERS! A leading mill supply house near you stocks Dayton V-Belts.. Look for the name in the yellow pages of your telephone directory

Dayton Rubber

THE MARK OF TECHNICAL EXCELLENCE IN NATURAL AND SYNTHETIC RUBBER

THE WORLD'S LARGEST MANUFACTURER OF V-BELTS

Do YOU Buy on FACTS or *Fancy*?



Pictured: Heavy duty coil type Pritchard Induced Draft Tower in Refinery service.

PRITCHARD COOLING TOWERS

invite factual pre-purchase analysis!

Other Pritchard SPECIALIZED EQUIPMENT

- "Airdfin" Air-Cooled Heat Exchangers
- Evaporative Condensers and Engine Coolers
- Cooling Towers, All Types and Capacities
- Shell & Tube and Atmospheric Heat Exchangers
- "Hydryer" Air and Gas Drying Units
- "3-Zone" Cleaners and Separators for Air, Gas and Steam
- Air Treaters for Purification and Positive Control of Moisture and Temperature in Air Conditioning Systems

Here's another actual case (on which we can show you the file) of a power plant job in which careful pre-purchase evaluation again proves a Pritchard cooling tower to be the "best buy." It's a typical example of what Pritchard features, efficiency and operating economy, mean to the owner. We can cite dozens of others.

Item	Lower Bid Tower	Tower B	Tower C	Tower D	Pritchard Tower
Percentage Above Low Bid	—	13%	23%	29%	2%
Annual Operating Cost Percentage Above Low Bid	23%	28%	10%	7%	—
Fifth Year Evaluated Cost	$31,633	$34,608	$34,636	$35,661	$29,434
Twentieth Year Evaluated Cost	$71,874	$76,644	$71,419	$71,949	$62,104

Similar records are available on other Pritchard equipment also, weighing all practical considerations over a reasonable period of actual operation. These service histories all testify that Pritchard equipment engineered to your exact needs, will give *you* money-saving, trouble-free performance... the kind of performance that means PROFIT to you ... year after year.

J. F. Pritchard & Co., EQUIPMENT DIVISION, Fidelity Bldg., Kansas City 6, Mo.

HOUSTON, TULSA, PITTSBURGH, NEW YORK, SALT LAKE CITY, DETROIT, EL PASO, ATLANTA, DENVER, OMAHA, ST. PAUL, LOS ANGELES, ST. LOUIS, MEXICO CITY

J.F. Pritchard & Co.

ENGINEERS • CONSTRUCTORS • MANUFACTURERS

for the CHEMICAL • PETROLEUM • GAS and POWER industries

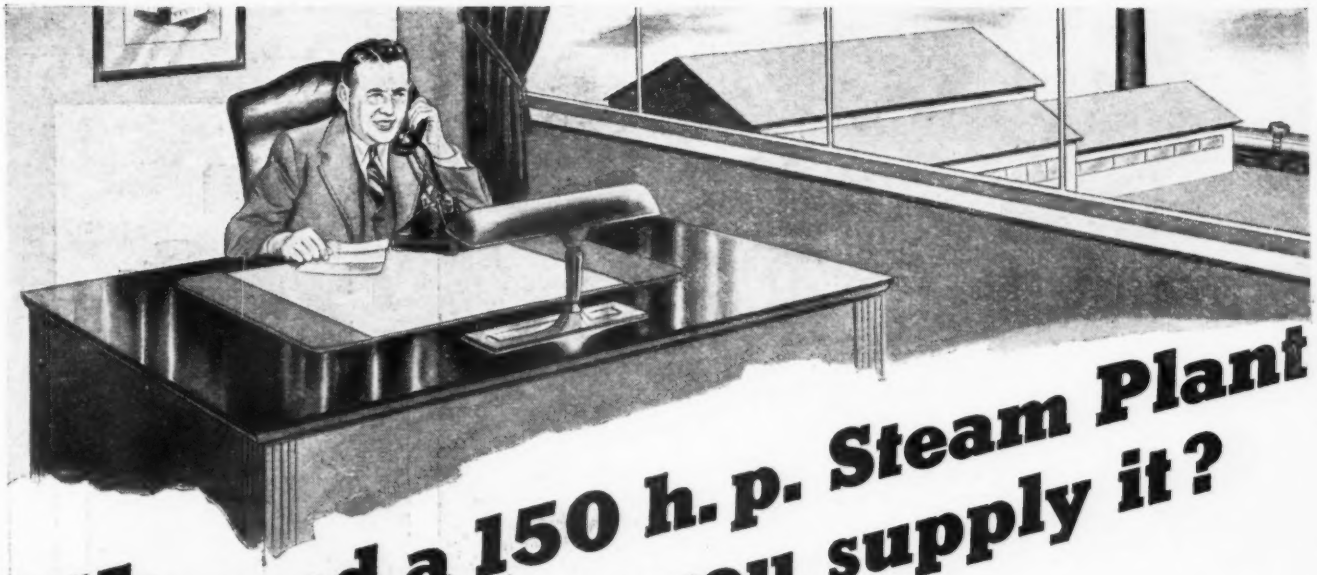
PROPOSED CHILDREN'S MEDICAL CENTER, BOSTON, MASS.

CASE FOR A SPECIALIST....

Our broad experience and specialized knowledge in every phase of engineering and construction often are employed during the period of preliminary planning as well as for actual construction of institutional buildings.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.



We need a 150 h.p. Steam Plant Can you supply it?

If you have Superior Combustion Industries, inc., on the other end of that phone, Mister, the answer is "Yes," and you've bought yourself a new steam plant. And whether you need 700 or 17,000 pounds of steam per hour, the answer is still really that simple. For Superior Steam Generators are furnished in 17 sizes; factory tested, factory guaranteed, and shipped completely assembled . . . . ready to be set down on your boiler room floor and go to work at a guaranteed thermal efficiency in excess of 80% . . . . backed by undivided responsibility. It's the modern way to buy a steam plant. It takes the guess out of purchasing and substitutes a *guaranteed result*. For a more complete description, write for Bulletin 101 today.

SUPERIOR FEATURES

Automatic Operation — All Superior Steam Generators can be furnished to give fully automatic operation burning any grade of fuel oil including Bunker C. Units can also be furnished to burn natural gas, or with combination gas-oil equipment.

Simple Installation — Shipped completely assembled, your Superior Unit can be operating within 24 hours after it arrives. Mounted on a rigid channel iron base, it needs no foundation other than a level floor capable of supporting its weight. Installation consists only of connecting the unit with water, electric and oil supply lines; steam head to your load; and stack to its outlet.

No Expensive Chimney — The *induced* draft fans are of sufficient capacity to furnish all the air required for maximum rating without need of a chimney other than a vent to carry off combustion gases.

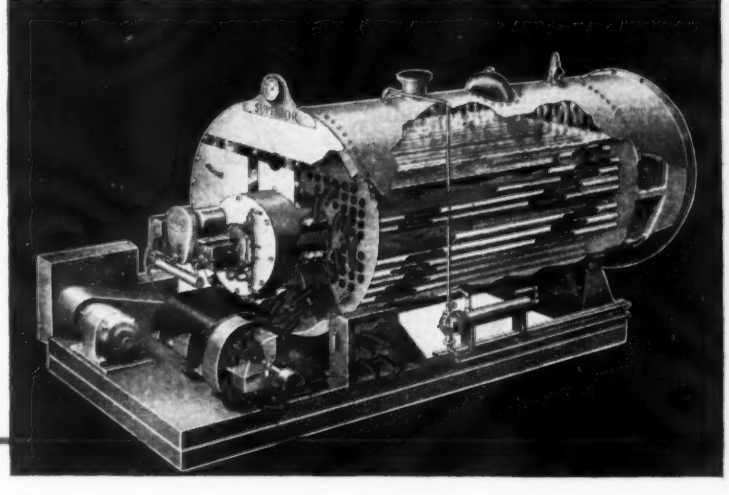
Clean, Quiet Operation — The evenly distributed *induced* draft results in a more quiet operation and eliminates danger of forcing gases into boiler room.

Quality of Steam — The unusually large steam space and the dry pan provided assure dry steam at the nozzle and ample reserve steam capacity. Large evaporating surface promotes quick steaming while preventing surging and foaming prevalent where evaporating surfaces are restricted.

Universally Approved — Built in accordance with and approved by the A.S.M.E., National Board, and the N.E.C. requirements; full insurance inspection and certificate are supplied with each unit. All state and local requirements can be met.

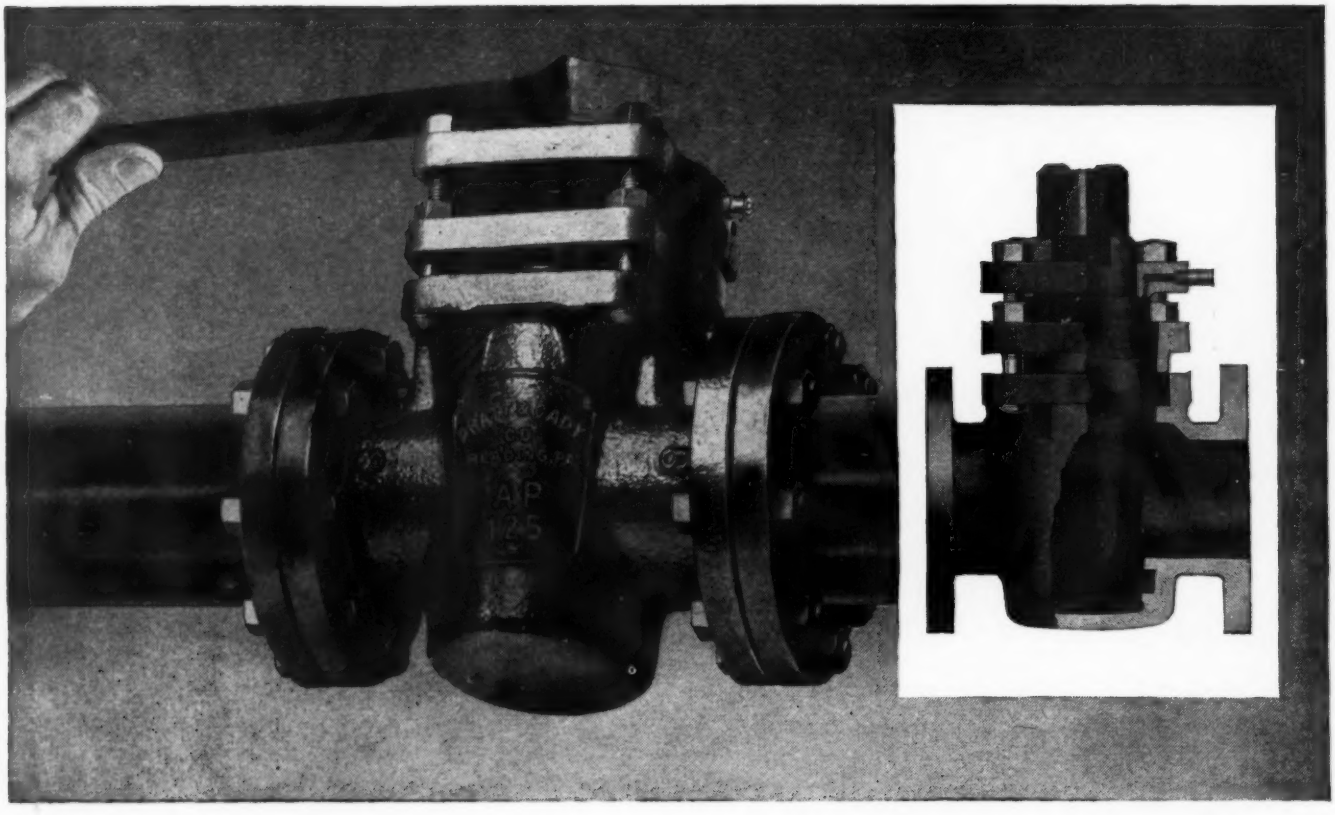
Capacities — Manufactured in 17 sizes from 20 to 500 b.h.p. to operate at pressures from 15 to 200 p.s.i.

The four-pass, *induced* down-draft, fire tube design of Superior Steam Generators (shown below) provides ample heating surfaces which result in high efficiency and quick steaming. Strategically located hand clean-out holes, which make water side accessible for cleaning, add long life to high efficiency.



Superior Combustion Industries, inc.

EMMAUS, PA.



EASIER WORKING, LONGER LASTING READING-PRATT & CADY A. P. COCKS

Asbestos-Packed Cocks serve best as a shut-off on lines that carry solids in suspension, viscous fluids, oils, etc.,—in short, where Globe, Angle or Gate valves fail or where conventional ground plug cocks prove unsatisfactory. R-P & C A. P. Cocks are made in cast iron, bronze and cast steel.

READING, PA.—U-shaped grooves in the body of this cock are packed solidly with asbestos, which is then vulcanized. This provides a bearing surface which absorbs expansion and results in easier operation by avoiding the friction of metal-to-metal contact.

Double Gland Feature

This feature shown in the illustration, results in easier operation and longer life than the Single Gland Asbestos Packed Cock. With it the plug is not jammed down unnecessarily by putting appropriate pressure on the top packing.

Other R-P & C Products

Reading-Pratt & Cady offers you a single responsible source for bronze, iron and steel globe, angle and check valves—Lubrotite gate valves—Bar Stock valves—cast steel fittings.

R-P & C distributors are located in principal cities.

ACCO

Reading, Pa. • Atlanta • Baltimore • Boston • Chicago • Denver • Detroit • Houston • Los Angeles • New York • Philadelphia • Pittsburgh • Portland, Ore. • San Francisco • Bridgeport, Conn.

READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

How much boiler water trouble is necessary?

THE ANSWER ISN'T FOUND IN A CRYSTAL BALL . . . it's simpler than that . . . *it's as much (or as little) as your present boiler water treatment makes it.*

Think a moment about your present boiler water treatment. Does it eliminate carryover . . . minimize scale and corrosion . . . reduce blowdown and save fuel? How much boiler water trouble are you having, and how much of it is necessary?

There's no one solution to all boiler water problems. It takes more than just adding a few chemicals to the system. Good results require a completely *individualized* water conditioning service that includes initial investigation, plant control, a daily testing program, periodic check-ups, analyses of water samples and regular engineering reports on plant operation. Such a service is rendered by the BETZ organization . . . Write today for details on what BETZ engineers might do for you to improve your present boiler water treatment. W. H. & L. D. BETZ, Gillingham and Worth Sts., Philadelphia 24, Pa. In Canada: BETZ Laboratories Limited, Montreal 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

SPEAKING OF LUXURY...

IT MAY NOT SEEM TO BE — **But every time you use a sledge hammer or any manual tool to unload hopper cars . . . it costs you money! It costs you time! It costs you production! Yes . . . a sledge hammer is a luxury!**

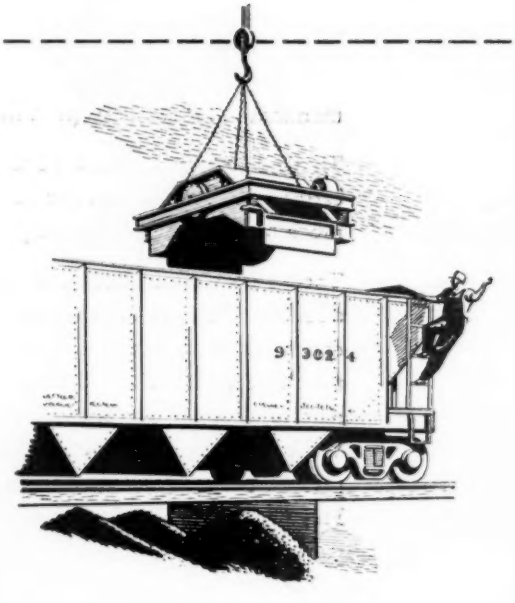
BUT WHEN ROBINS CAR SHAKEOUTS ARE PUT TO WORK—

They do your job cheaper. For example, two men can do the work of six or more men. And no expensive installations are needed.

They do your job faster. Packed hopper cars can be unloaded in minutes—not hours. This means cars and locomotives are released sooner.

They do your job better. Robins car shakeouts empty cars "broom clean." And they do so without injury to cars or loads.

So, solve your unloading problems . . . cut your unloading expenses with a Robins car shakeout. Write today for complete information.



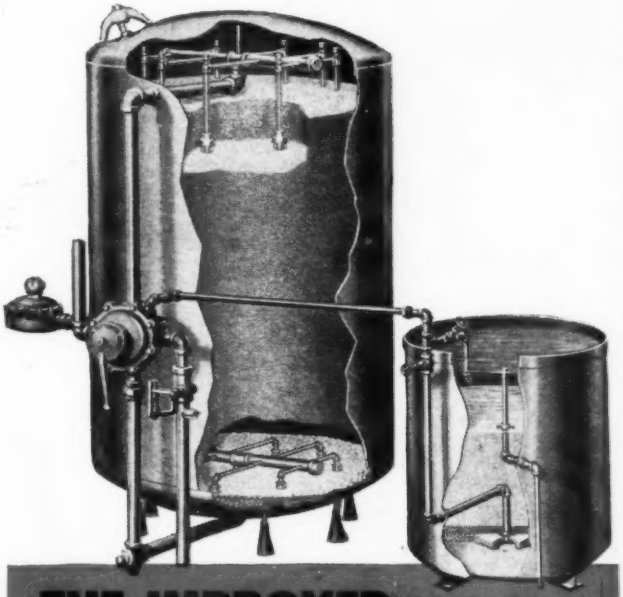
ROBINS
CAR SHAKEOUTS

"Job-Engineered" to solve your problem
CHEAPER . . . FASTER . . . BETTER

Robins Conveyors Incorporated, Passaic, New Jersey — Division of Hewitt-Robins Incorporated

One Minute to learn the facts

About this big advance in water softening



THE IMPROVED ELGIN GIVES 44% MORE SOFT WATER

Here are all the facts

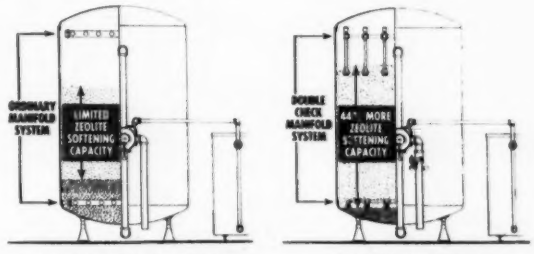
This new bulletin should be read by *all* soft water users. It's a factual presentation of this improved Elgin design, shows how a new standard of softener performance at reduced cost has been achieved. Ask for Bulletin 607. For hospitals, request Bulletin 608. For laundries, ask for Bulletin 609.

- ***What is this improved Water Softener?***

  The Elgin Water Softener is a truly revolutionary development which, size for size, delivers up to 44% more soft water than ordinary zeolite water softeners.

- ***How is its greater capacity obtained?***

  By an ingenious arrangement called the Double Check Manifold system. It permits a deeper water softening bed and at the same time prevents escape of zeolite. The larger zeolite bed, along with increased efficiency achieved by better distribution and more effective backwashing, gives this greater capacity. The diagrams tell the story.


ORDINARY MANIFOLD SYSTEM
LIMITED ZEOLITE SOFTENING CAPACITY
DOUBLE CHECK MANIFOLD SYSTEM
44% MORE ZEOLITE SOFTENING CAPACITY

ORDINARY WATER SOFTENER DESIGN — **ELGIN WATER SOFTENER DESIGN**

- ***What about investment cost?***

  It's soft water you really buy. The Elgin meets your needs with a smaller unit, and therefore a smaller investment.

- ***How about operating and maintenance costs?***

  Substantially reduced, for three important reasons. First, the Double Check Manifold provides more thorough backwashing, requires less regenerating salt and wash water. Second, the zeolite is kept clean and active for more efficient operation and longer life. Third, since escape of zeolite is mechanically barred, no costly periodic zeolite additions are necessary.

Any make of zeolite water softener can be modernized this Elgin way at surprisingly low cost. Remember, however, Elgin alone offers this ingenious development with its many important advantages that no other water softener can match.

ELGIN SOFTENER CORPORATION

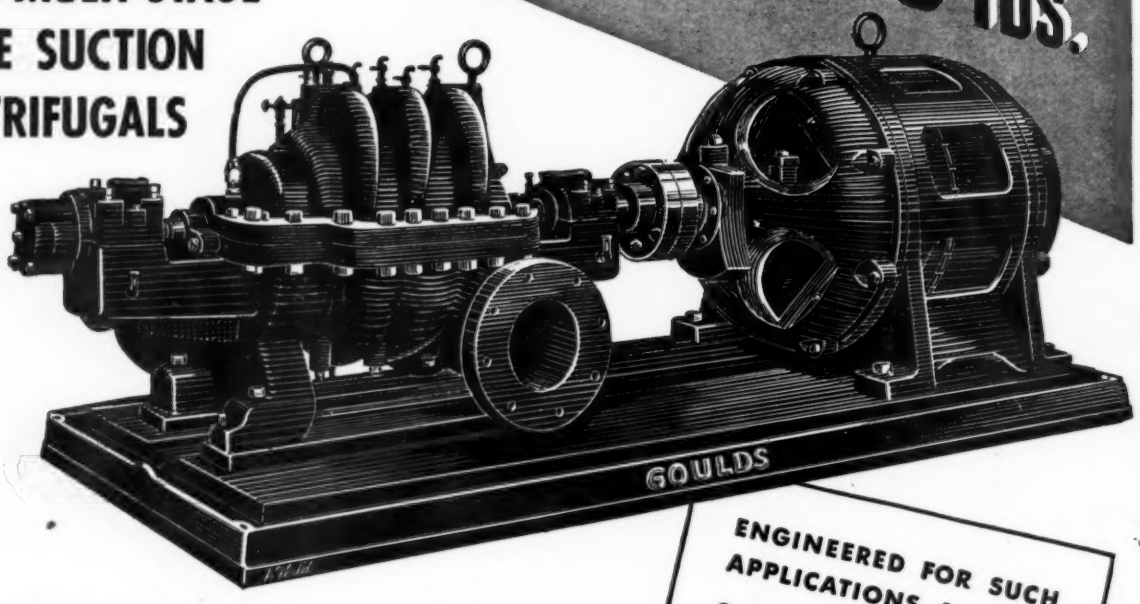
130 N. GROVE AVENUE, ELGIN, ILLINOIS

SOFTENERS ★ FILTERS ★ WATER TREATMENT ★ BOILER WATER CONDITIONING

FOR PRESSURES UP TO 350 lbs.

Goulds

Fig. 3330 MULTI-STAGE SINGLE SUCTION CENTRIFUGALS



ENGINEERED FOR SUCH APPLICATIONS AS...

- General water service.
- Humidifier service in textile mills.
- Dewatering mines.
- Boiler feeding.

It's not uncommon for Goulds Multi-Stage Single Suction Centrifugal pumps to operate years without maintenance . . . not that the practice is advocated. But these pumps are popular with pump users because they are rugged. As it does with most pumps in the line, Goulds builds this series in sizes which enable you to select the one that meets your requirements most economically. Specifically, this means pumps of two to six stages and a capacity range of 100 to 1700 G. P. M. with heads up to 800 ft., depending on capacity.

THRUST BALANCE PERMANENT

An important thing to keep in mind about these pumps is thrust balance. To absorb any unbalanced thrust which might occur from clogged impellers or uneven or excessive wear at sealing surfaces, a double acting, double row ball thrust bearing is provided, securely locked in position. This operates in a continuous oil bath. It is one of the features contributing to low maintenance cost and the popularity of this pump.

ONE OF MANY TYPES

This is one of many types of centrifugals manufactured by Goulds. Whether you need single or double suction, single or multi-stage units, Goulds has the pump for the job. Write or call Pump Headquarters or your nearest Goulds Office.

Goulds PUMPS, INC.

SENECA FALLS, N.Y.

the PUMP FOR the JOB

24 Hours a Day.... 6 Years

DETROIT

JOHN C. ROSE
Commissioner of Finance

E. W. WILLIAMS, Mayor

JOHN V. WALKER
Commissioner of Public Works

Power & Water Department
CITY OF CORBIN
Corbin, Kentucky

Detroit Stoker Company
General Motors Building
Detroit 2, Michigan

Gentlemen:

Replying to your recent letter, we have no objection to your using the pictures of our plant in your new catalog.

Our Detroit RotoStoker, installed in 1940, has been in almost continuous twenty-four hour per day operation for the past six years. We have not had one single outage due to stoker trouble and our maintenance expense has been very low.

Your RotoStoker is certainly dependable and operates with high efficiency.

Yours very truly,

Electric Power and Water Department

H. C. Craft

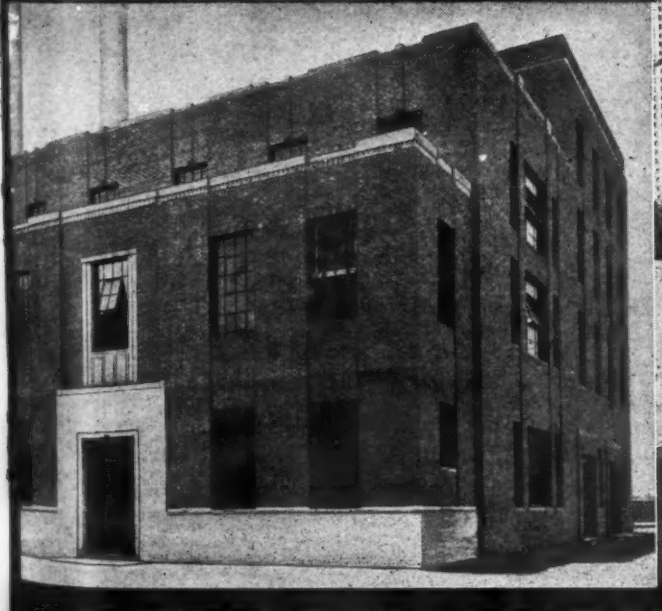
H. C. Craft, Superinte

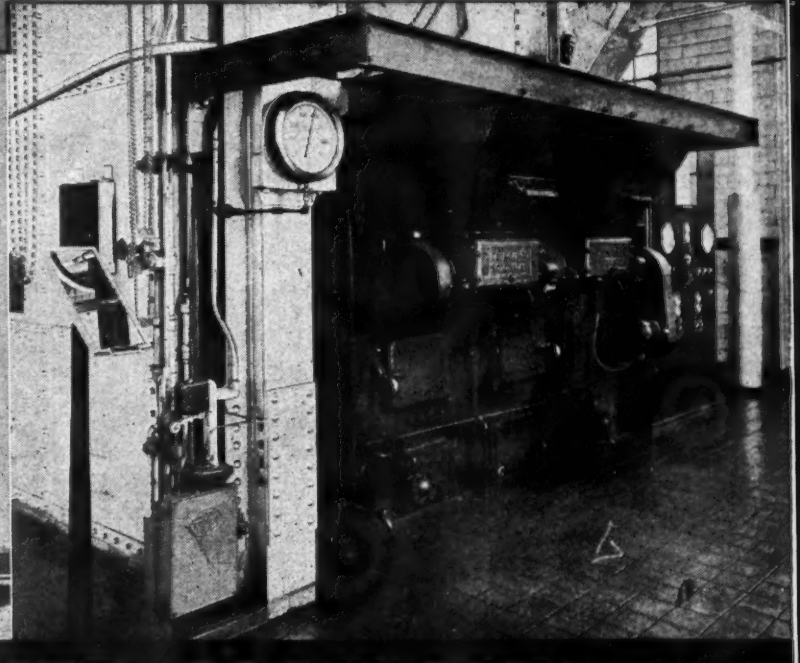
HCC:mp

READ WHAT THIS CUSTOMER *Says...*

ROTOSTOKER

The Detroit RotoStoker—an overthrow spreader type stoker — will burn most types of coal, handle widely fluctuating loads and give you availability plus.





DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

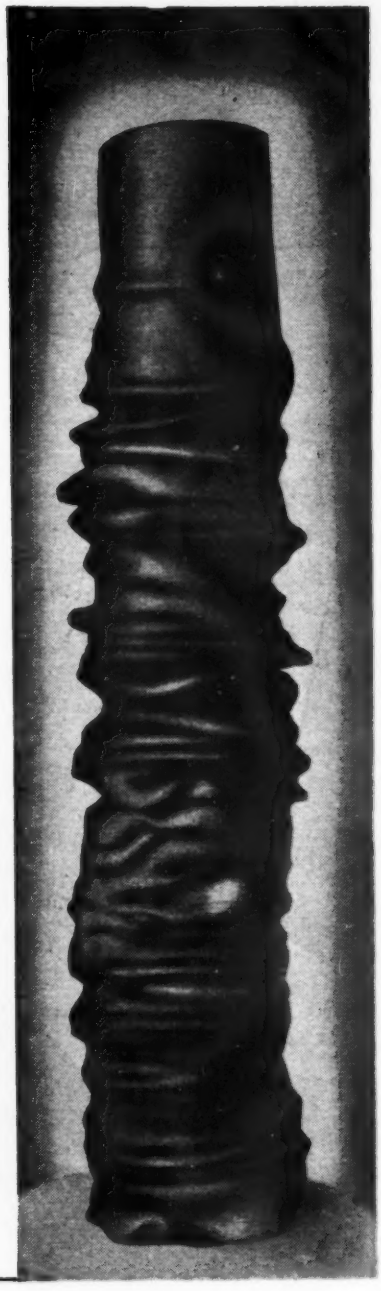
District Offices in Principal Cities • Works at Monroe, Michigan

We call this

the "ACCORDION TEST"

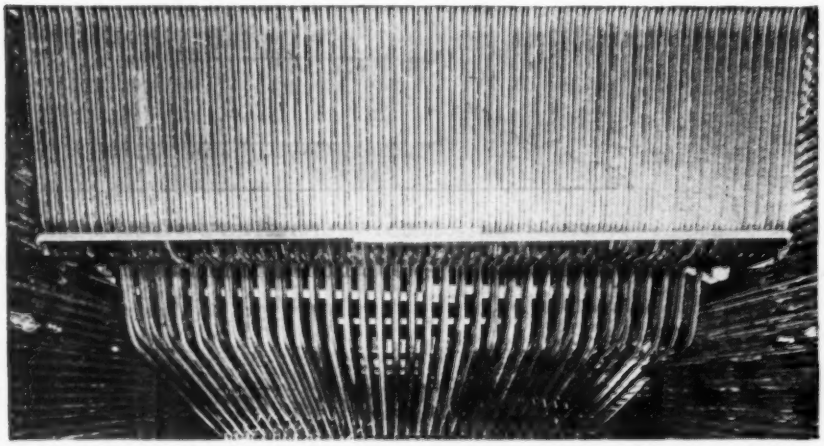
It looks like a section of rubber hose with a bad case of cramps.

It's a NATIONAL Seamless Boiler Tube after being mashed together from the ends. Only a tube that is pierced from solid steel—and not just ordinary steel either —could stand this kind of treatment without wall failure.



WE show this unusual test because we think it illustrates at a glance why we have always emphasized the "Walls Without Welds" construction of U·S·S NATIONAL Seamless Boiler Tubes . . . why users say they are unsurpassed for safety.

There are other reasons* too, why NATIONAL Seamless Tubes, for more than half a century, have earned the complete confidence of power plant operators. As temperatures and pressures have gone up, these superior tubes have never been found wanting. Under increasingly severe conditions they have continually demonstrated their ability to ensure lasting economy and superb performance.



In this boiler which generates 615,000 lb. of steam per hour, at 1,475 psi. and 925°F., NATIONAL Seamless "Walls Without Welds" insure absolutely uniform wall strength.

**Higher Creep Strength*

All steels used in U·S·S NATIONAL Seamless Boiler Tubes are of the completely "killed" type—the steel is thoroughly deoxidized before being cast into ingots. Tests have shown conclusively that "killed" steels have better creep strength at elevated temperatures than "rimmed" steels of similar chemical analysis commonly used for other types of tubes.

**Superior Heat Transfer Characteristics*

U·S·S NATIONAL Seamless Boiler Tubes made of completely "killed" type of steels have uniform density, freedom from laminations, and soundness of structure throughout the metal walls. This provides superior heat transfer characteristics with minimum danger of "hot spots" —a worthwhile consideration in every kind of boiler tube service.

**Better Working Properties*

U·S·S NATIONAL Tubes can be readily bent, expanded, flared, beaded, and rolled tightly into headers or sheets without splitting or fracture. These qualities greatly reduce construction and maintenance costs. Complete annealing insures the right balance between strength and ductility for good performance and utmost ease of installation.

WALLS WITHOUT WELDS

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

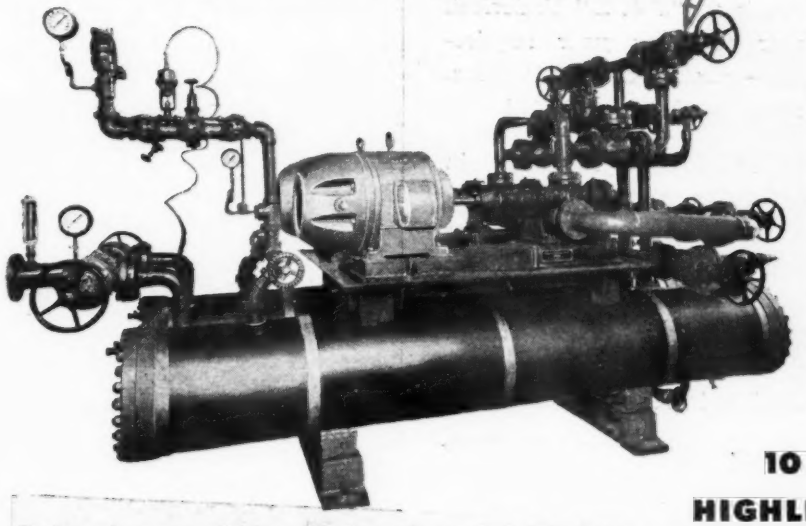
Tubing Specialties Division

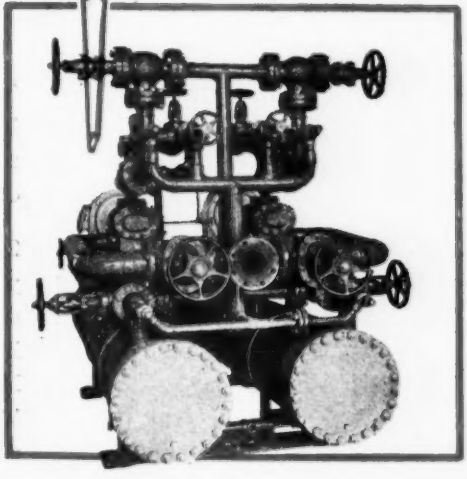
Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

NATIONAL TUBE COMPANY · USS · STEEL · UNITED STATES STEEL

UNITED STATES STEEL

ENCO designed pump sets eliminate fuel-oil preparation troubles in the planning stage





Today when overall plant efficiency is so vital, it is more necessary than ever for you to be sure that your fuel oil pumping and heating system is designed to provide peak performance *to meet your special plant conditions.*

Many years of experience in planning these installations enables ENCO engineers to design the unit that suits your operating conditions best . . . "tailor made" so that every part is integrated to provide you with easier control and longer maintenance-free operation.

ENCO pumping and heating sets are both simple and economical to install, too. They are delivered in a coordinated unit, ready to connect to station piping and run. And every ENCO Fuel Oil Pumping and Heating Unit is completely tested under high pressures before it is shipped to you.

ENCO "tailor made" pump sets are available in full or semi-automatic models with single or duplicate combinations of steam piston, turbine or electric driven rotary, or screw-type pumps. Pumps may be interconnected with one or two straight-tube heaters. Pumping sets with all-welded pipe connections are also available on request.

For further information on ENCO Automatic Fuel Oil Pumping and Heating Sets, write for Bulletin O.B.—37.

10 PLUS FEATURES THAT HIGHLIGHT ENCO'S SUPERIORITY

1. COMPLETELY AUTOMATIC OPERATION is assured by automatic temperature and pressure regulation valves.
2. COORDINATED DESIGN SAVES SPACE. All equipment essential to the preparation of fuel oil for combustion is contained in one compact unit.
3. INDIVIDUALLY DESIGNED to meet the specific needs of the particular power plant in accordance with its exact operating requirements.
4. ALL PARTS VISIBLE AND ACCESSIBLE for easy operation, maintenance and repair.
5. PUMPS AND HEATERS are interconnected to provide maximum flexibility of operation.
6. SAFETY VALVES protect individual parts where required.
7. EASIER MAINTENANCE — LESS SERVICE-TIME FOR CLEANING because straight tube, multi-pass heaters with removable heads are used.
8. PUMPS OPERATE AT MODERATE SPEED. Heaters designed to give the correct viscosity and velocity without fouling.
9. SMOOTHER FLOW OF CLEAN FUEL TO FURNACE. Air chamber for each piston pump prevents pulsations — pressure regulator for rotary pumps. Twin type strainers provided to keep atomizer tips from clogging.
10. CLEANER BOILER ROOM . . . all overflows connected to a common outlet; flanged drip pan catches oil drip.

EC-466

THE ENGINEER COMPANY
75 West Street
New York 6, N. Y.

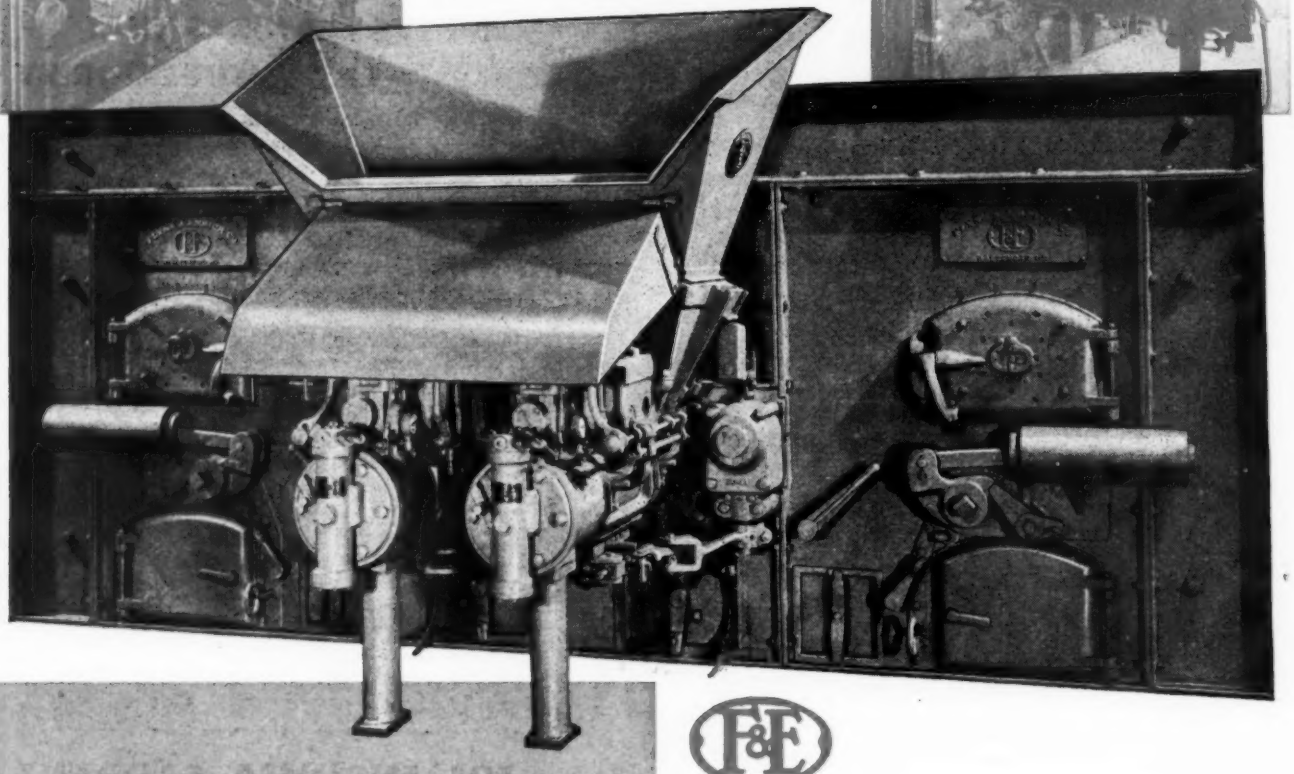
Canadian Representative: F. J. Raskin, Ltd.
370 Rachel E., Montreal, P. Q.

SERVING OVER 700,000
BOILER HORSEPOWER

"F & E"
UNDERFEED STOKERS

There is an "F & E" Underfeed Stoker to meet your requirements—whether they be 1000 lbs. of steam per hour or 40,000!

See the "F & E" representative in your locality, your own consulting engineer or write manufacturer for information that tells WHY and HOW "F & E" Underfeed Stokers increase output of boilers, reduce fuel bills, provide dependable operation, increase efficiency.



THE ONLY STOKER
WITH THIS COMBINATION OF ENGINEERED FEATURES
1-Choice of Electro-Hydraulic or Steam Ram Drive; 2-Internal Timer Governor; 3-Sliding Bottom Retort; 4-Renewable Ram Case Liner; 5-Exterior Fuel Bed Adjuster; 6-High Efficiency Tuyeres

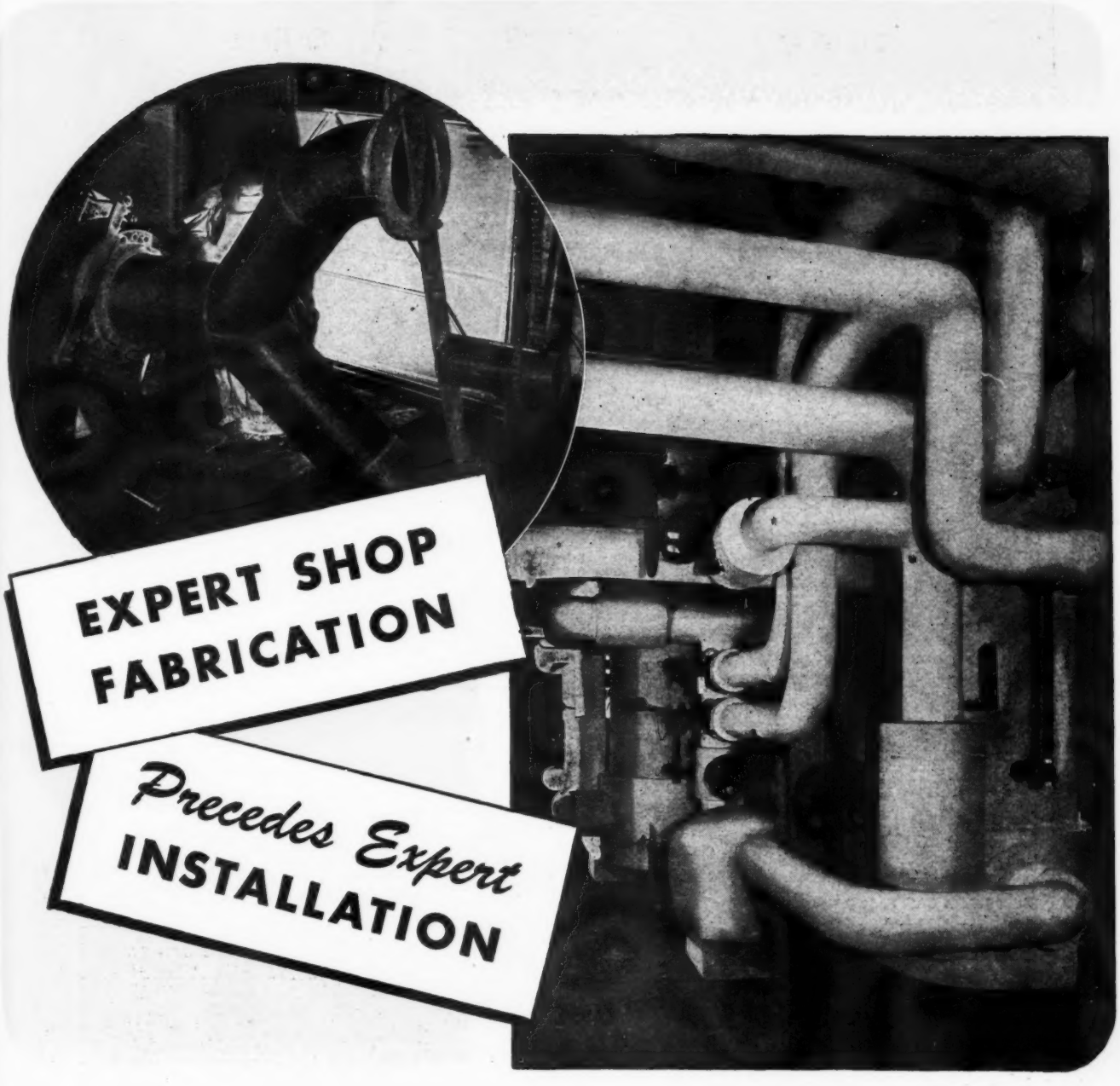
F&E

FLYNN & EMRICH CO.

Established 1842

HOLLIDAY & SARATOGA STREETS, BALTIMORE 2, MARYLAND

Representatives in Principal Cities

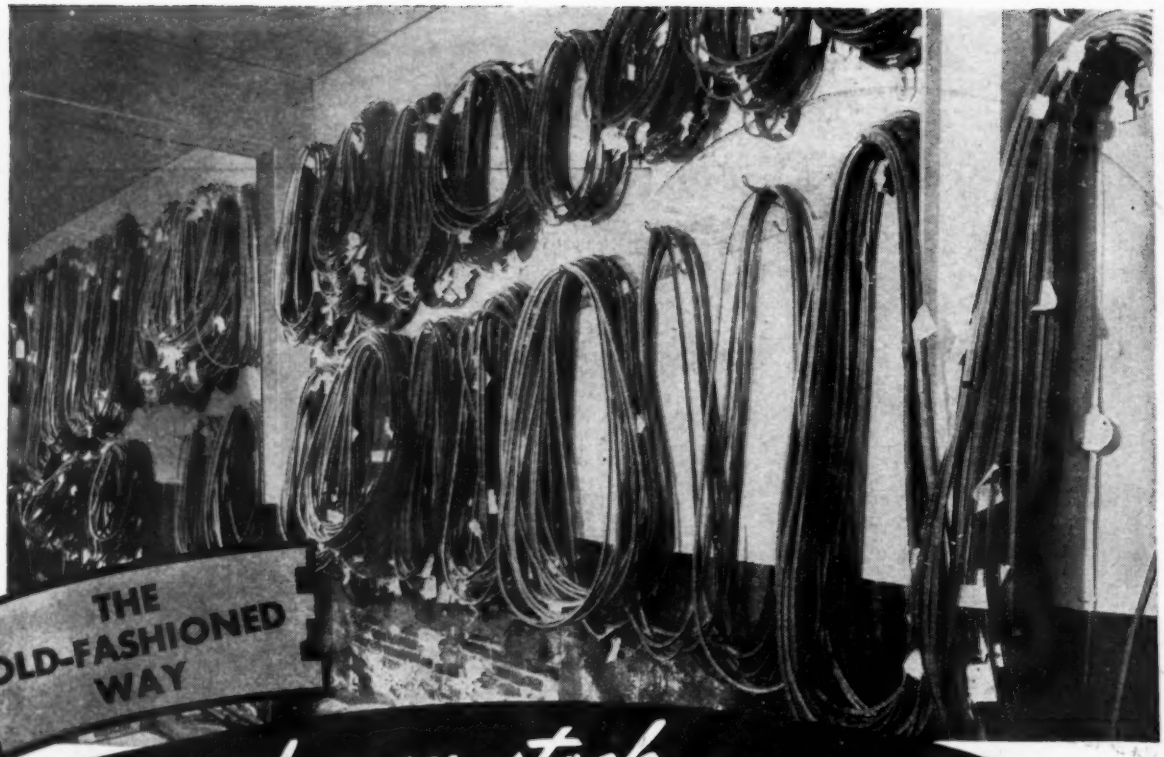


EXPERT shop fabrication of sub-assemblies – as large as shipping facilities permit – makes possible simpler, faster, cheaper erection. These sub-assemblies – produced under ideal conditions and with the aid of equipment not always available in the field – are stress relieved, pressure-tested, checked for dimensional alignment, cleaned and inspected, and are ready to slip into place.

Pre-fabrication is economical and efficient for power piping of every type and material. Our engineers will be glad to discuss with you its applicability to your particular problem.

Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street — Pittsburgh, Penna.

Woolworth Building, New York
Chamber of Commerce Bldg., Indianapolis
Book Tower, Detroit
525 Market Street, San Francisco
315 West 9th Street, Los Angeles
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston
Whitehead Building, Atlanta



THE OLD-FASHIONED WAY

How do you stock your V-belts?

WHY stock a costly and confusing assortment of endless V-belts when you need only a few reels of Veelos, the link V-belt? With only four sizes of Veelos you can make up 316 standard sizes of endless belts. With Veelos, storing spare sets of belts for individual drives becomes outmoded. Expensive, wasteful belt inventories are eliminated . . . deterioration of spare V-belts is ended.

Veelos on reels assures a neat, orderly stockroom. Space is saved. Paper work is reduced. Any desired length of V-belt is always available. Veelos is made in all standard widths, fits all standard grooves, is packaged on standard 100-foot reels.

Veelos sales engineers are located in all principal cities; over 300 distributors throughout the country.

THE MODERN WAY

Just four reels of Veelos will provide 316 sizes of endless V-belts.

VEELOS
THE LINK
V-BELT

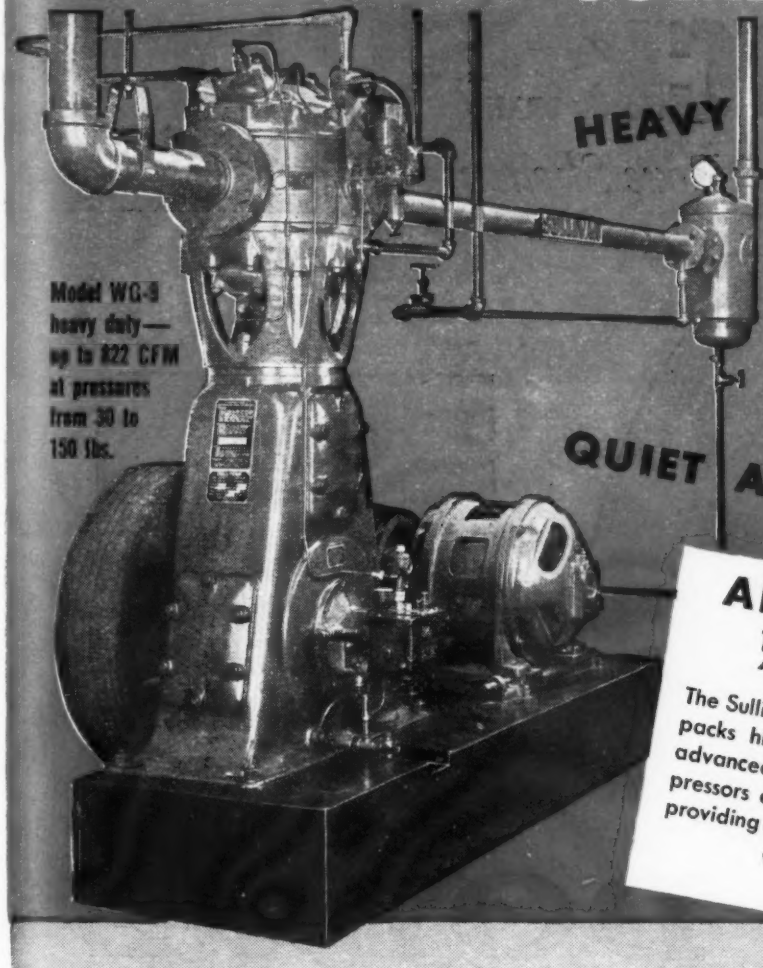
Adjustable to any Length
Adaptable to any Drive

MANHEIM MANUFACTURING & BELTING CO.
MANHEIM, PENNSYLVANIA

Tested • Proved • Adopted . . . by American Industry

SAVE FLOOR SPACE

WITH EFFICIENT SULLIVAN COMPRESSORS



Model WG-9 heavy duty—up to 822 CFM at pressures from 30 to 150 lbs.

HEAVY DUTY

TROUBLE FREE

PRECISION-BUILT

QUIET AND COMPACT

AIR COMPRESSORS
¼ HP to 600 HP

The Sullivan WG-9, like *all* Sullivan Air Compressors, packs high capacity into minimum space through advanced engineering and design. Sullivan Compressors are in satisfactory use throughout industry, providing dependable air power year in and year out.

WRITE FOR BULLETIN A-43 WHEN YOU WANT COMPLETE DETAILS.

SULLIVAN

STATIONARY AND PORTABLE AIR COMPRESSORS

W&D 1506

Consult a Joy Engineer

SULLIVAN DIVISION

JOY MANUFACTURING CO.

GENERAL OFFICES: HENRY W. OLIVER BUILDING • PITTSBURGH, PA.

Complete unit.
Slip it on, line it up
and tighten while
sighting.

The simplest,
surest mechanism ever
devised for holding
wheels to shafts.

TAPER-LOCK BRAND

A New Cost-Saving Taper Bore Sheave

Holds fast to
the shaft with firmness
equivalent to a
shrunk-on fit.

Disengages
with less effort than
any other sheave.
Easy on. Easy off.

Complete
range of sizes in
Dual Duty (A and B);
B, C and D grooves.

DODGE

of Mishawaka, Ind.

For details about cost-saving developments in power transmission equipment, call the Transmissioneer—your local Dodge distributor. He's factory-trained, qualified to suggest ways to improve machine performance and increase production. Look for his name under "Power Transmission Equipment" in your classified telephone directory.

DODGE MANUFACTURING CORP., MISHAWAKA, INDIANA

Copyright, 1947, Dodge Mfg. Corp.

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,
ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

A New HIGH IN PRESSURE BLOWING

"Buffalo" TYPE "CC" COMPRESSORS

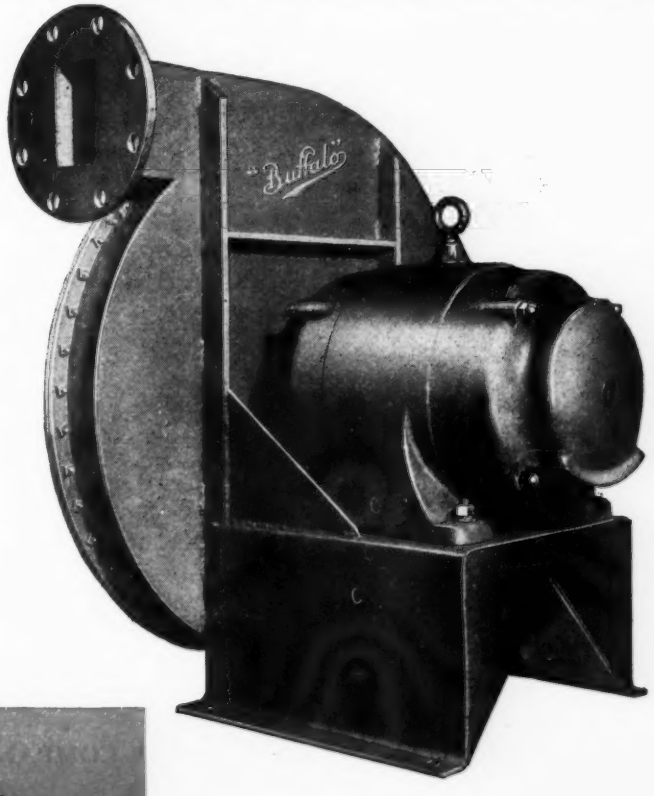
- **FOR HANDLING AIR FOR OIL OR GAS FURNACES**
- **FOR SCALE AND WATER BLOWOFF**
- **FOR HIGH PRESSURE WORK IN GLASS, STEEL AND CHEMICAL PLANTS**
- **FOR EXPERIMENTAL WORK AND MANY OTHER JOBS**

If your air needs include high pressures at low to moderate air volumes (and at low cost), "Buffalo" Centrifugal Compressors will meet these needs extremely well. They offer you economies all up and down the line . . . single stage, precision-balanced rotors that turn without wasteful vibration . . . sturdy construction that lasts and lasts.

Full engineering data in Bulletin 3553, yours on request.

4 LBS. IN A SINGLE STAGE!

You do not need several stages to develop this kind of high pressure with these Buffalo Blowers. Note heavy welded steel plate construction in the housings.



BUFFALO FORGE COMPANY

488 Broadway Buffalo, N. Y.

Canadian Blower and Forge Co., Ltd., Kitchener, Ont.

POWER

EXIDE...A NAME THAT STANDS FOR *EXTRA POWER* IN DIESEL CRANKING

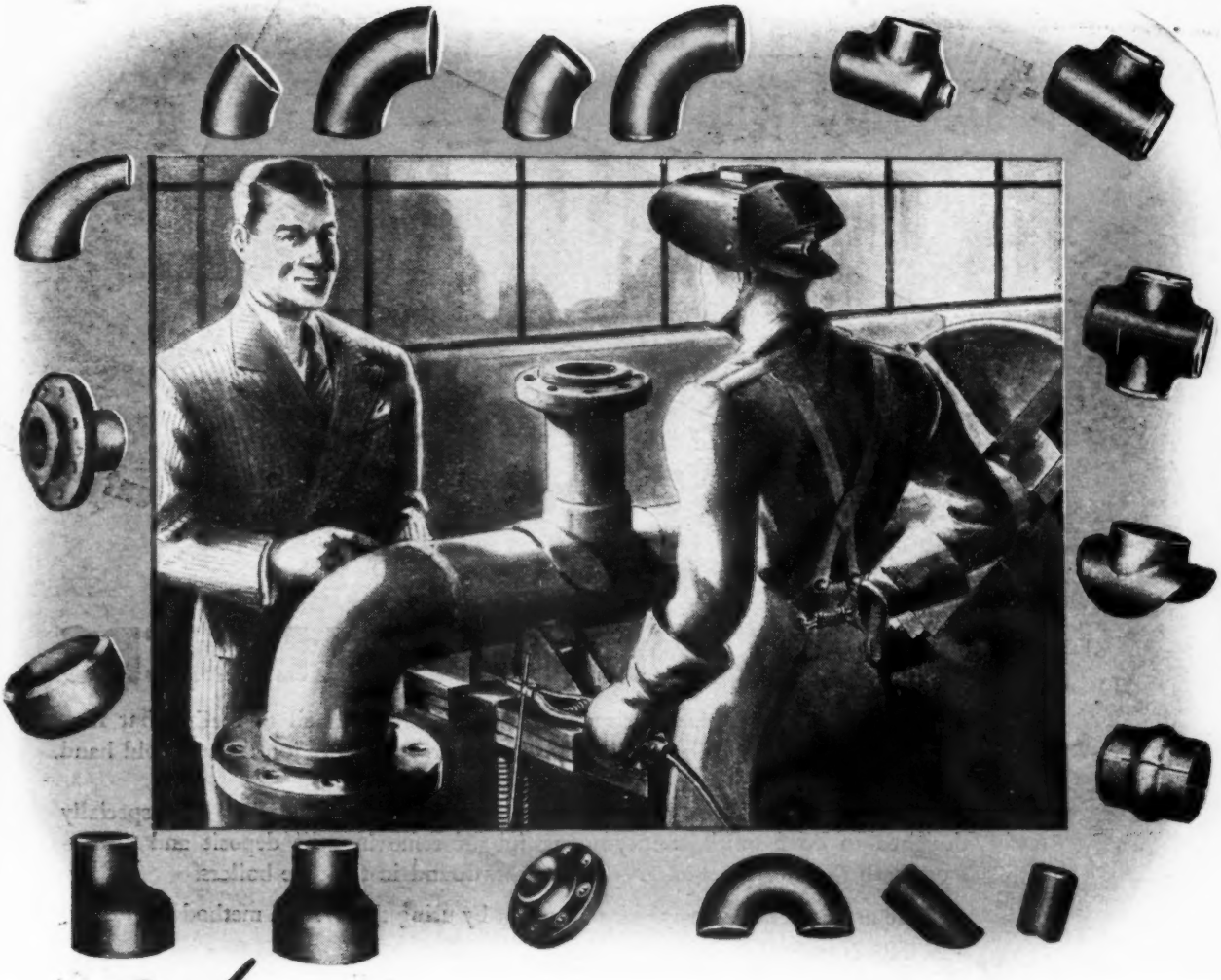
Diesel engines start when Exides do the cranking, for Exides have the extra power needed to supply the high cranking speed that Diesel starting demands. And sturdy Exide construction assures a long-life of dependable service with exceptional ease of maintenance.

Exide Batteries for Diesel Engine Cranking are designed specifically for this extremely tough battery job. They are products of Exide engineering and manufacturing skill, plus an experience of many years of close identification with the Diesel engine industry.

Write today for FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Diesel Cranking Batteries.

Exide
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto



Ask **THE WELDER OF PRESSURE PIPING**

what he thinks of

MIDWEST WELDING FITTINGS

You will find that he gives them hearty approval. Piping welders generally have a high appreciation of the exceptional dimensional accuracy and uniformity of Midwest Welding Fittings . . . their job is easier and they can turn out better work faster.

Midwest Welding Fittings have extraordinary dimensional accuracy because particular precautions are taken in their manufacture. Midwest Welding Elbows, for example, are made slightly oversized, then reheated to forging temperature and given a final accurate sizing in compression. This provides accurate dimensions, true circular section, and uniform wall thickness. Comparative corrosion tests as well as tensile and ductility tests have proved the beneficial effect of forging the metal in compression.

Welders also appreciate the wide variety of Midwest Welding Fittings . . . including "Long Tangent" elbows and reducing elbows. There is a fitting for practically every condition he encounters. Ask the local distributor or our nearest office for Bulletin WF-41.

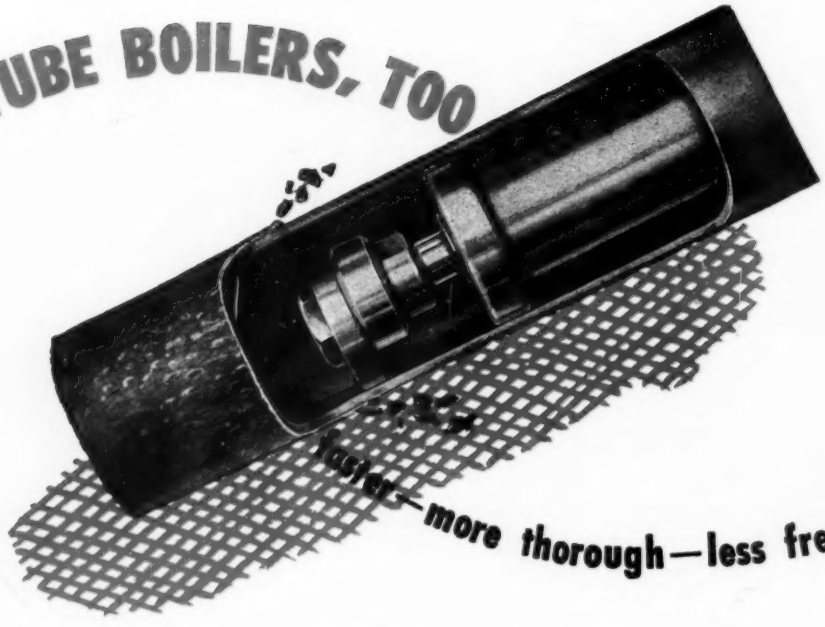
MIDWEST

PIPING & SUPPLY COMPANY, INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Sales Offices: New York 7—30 Church St. • Chicago 3—645 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St. • Distributors in Many Cities

FOR FIRE-TUBE BOILERS, TOO



faster—more thorough—less frequent cleaning

with WILSON TUBE CLEANERS

Operators of small plants using fire-tube boilers often fail to realize that fast-acting, mechanical tube cleaners will do a quicker, less costly job than the old hand operated methods on descaling tubes in these installations.

The Wilson Tube Cleaning Equipment you see on this page has been specially designed to do a quick, money-saving job of removing the deposit and scale—from both *fire and water sides*—of the tubes found in fire-tube boilers.

Here are five reasons why *you* will profit by using the Wilson method of cleaning this type of tubular apparatus:

1. Water side scale is removed. *The Fire-tube Vibrator Head jars loose the outside deposit without damaging the tube.*
2. Cleaning time is cut — *often from days to a few hours.*
3. Complete cleaning is assured *because the action of the expanding brush keeps the brush wires in constant, even contact with the tube walls.*
4. Heat transfer is improved and fuel is saved *because scale is removed from both water and fire side of tubes.*
5. Fewer cleanings are required *because soot and fire scales will not readily adhere to walls burnished smooth by expanding brush.*

Whether your cleaning problem involves high-pressure, large-output units or small fire-tube boilers, Wilson has the tube cleaning equipment to do the job. Different motors and cutter heads are available for efficient, economical removal of every type of deposit in straight or curved, ferrous or non-ferrous tubes from ⅜" to the largest ever cleaned. Write for complete information. Please address Dept. M.

THOMAS C. WILSON, INC.
21-11 44th Avenue, Long Island City 1, N. Y.

TW-734

Vibrator Head for removing scale from water side of fire tube boilers.

ST series air or steam motor. Available for straight tubes from 2" to 4" O.D.

Expanding brush for removing soot from fire tubes and burnishing tubes.

WILSON
TUBE CLEANERS

CONFIDENCE . . . how much is it worth?

IN 1841, two years before the first telegraph line was installed in this country, and when there were but 27 states in the Union, John August Roebling was inspired with the idea of making a new kind of rope of unheard of strength and flexibility. His confidence in his idea caused him to risk everything he had on the development of his new rope.

How much is his confidence worth to Industry today, which couldn't turn a wheel without the modern wire rope?

Today, the John A. Roebling's Sons Company invests much time, effort and money in the development of improved products to keep alive the confidence of its many customers.

Roebling values this confidence as its greatest asset. That's why it offers you the greatest value for every dollar you invest . . . in *any* Roebling product.

HOW TO SAVE WIRE ROPE DOLLARS

Wire rope is a machine of many parts and, like any machine, even the finest of wire ropes can be destroyed quickly through faulty installation or improper maintenance. To insure against this possibility, Roebling established its Field Engineering Service.

Every Roebling Field Engineer has a thorough knowledge of wire rope . . . its types, its uses, its features and limitations. This knowledge plus the experience he gains in his daily contacts can be a great asset to you . . . helping you to solve those tough wire rope problems . . . giving you more service for each wire rope dollar.

Get to know your Roebling Field Engineer. Call him at your nearby Roebling Branch Office.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

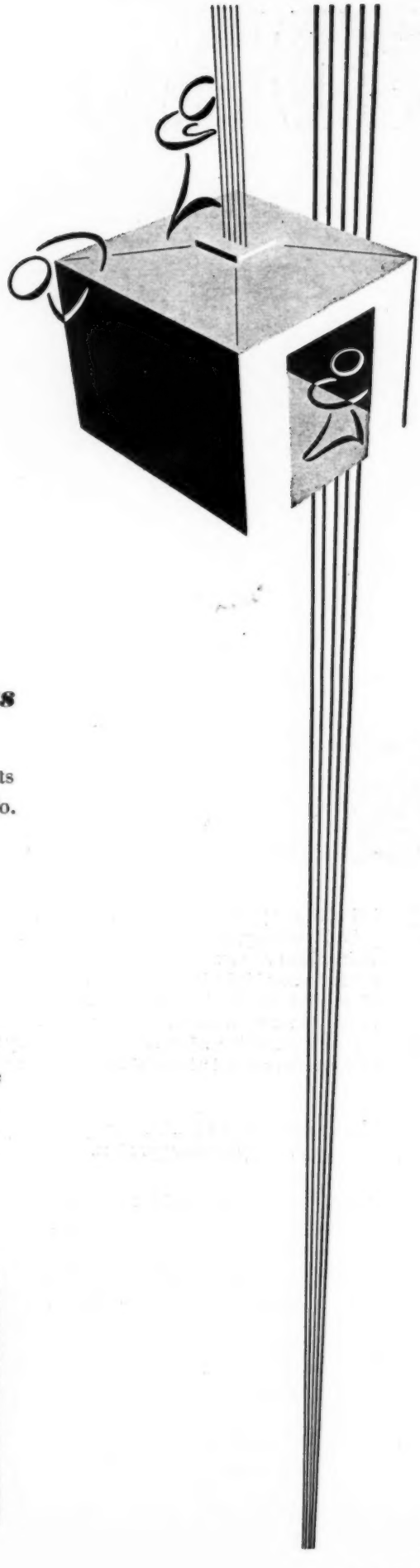
FOR EXAMPLE—"BLUE CENTER" STEEL WIRE ROPE

Roebling entrusts your confidence in Roebling and Roebling products to the performance of its "Blue Center" Steel Wire Rope. It is the best rope Roebling knows how to make. It is available as preformed or non-preformed, in a complete range of sizes and constructions to meet a great variety of operating conditions. Its uses are almost unlimited and its performance is consistently economical.

Manufacturers of Wire Rope and Strand • Fittings • Slings • Screen, Hardware and Industrial Wire Cloth • Aerial Wire Rope Systems • Hard, Annealed or Tempered High and Low Carbon Fine and Specialty Wire, Flat Wire, Cold Rolled Strip and Cold Rolled Spring Steel • Ski Lifts • Electrical Wire and Cable • Suspension Bridges and Cables • Aircord, Aircord Terminals and Air Controls • Lawn Mowers

ROEBLING

A CENTURY OF CONFIDENCE



clock stopper

Otis *maintenance* for Otis *elevators*

Ordinarily, you would expect elevator maintenance costs to increase as equipment grows older. Ordinarily they do.

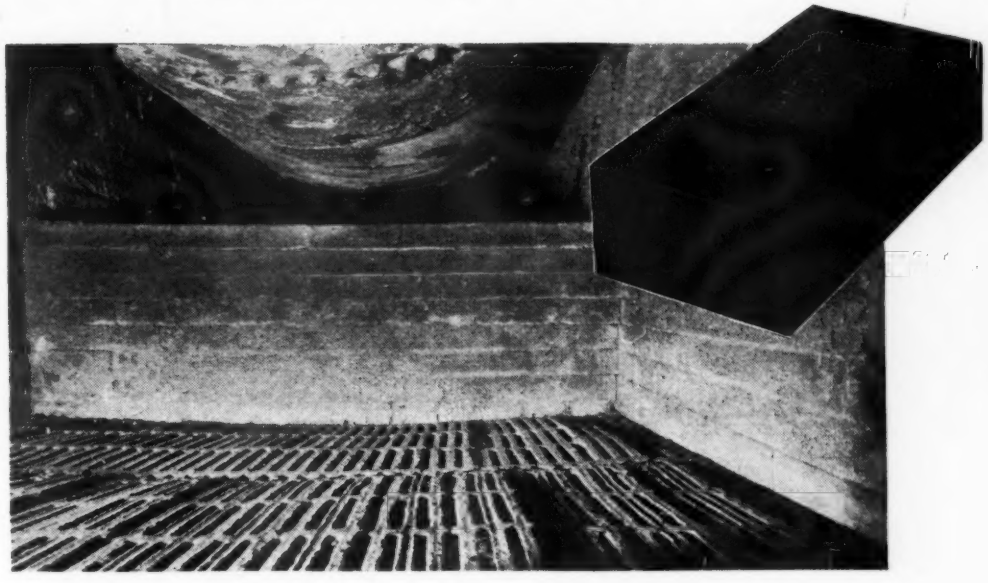
But not so with Otis Maintenance. For this is not an ordinary service. It is complete maintenance by a manufacturer who has demonstrated that properly maintained elevator equipment is unaffected by age.

Otis Maintenance rates are adjusted every *five* years in accordance with prevailing costs of labor and material. They are never increased due to age of the equipment. If your elevator is new when placed in our care, the rate continues as on a "new" elevator for the duration of the contract.

Every Otis Maintenance contract increases in value to the building owner as time goes on. Therefore, the sooner you start . . . the more you save.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

For Longer Life in Boiler Furnaces Use Norton Company's CRYSTOLON BRICK



For longer life in boiler furnaces power engineers specify Norton Company's CRYSTOLON Brick because of these qualities: (1) high refractoriness, (2) chemical stability, (3) great strength at elevated temperatures, (4) remarkable resistance to abrasion, (5) greater resistance to spalling than any other refractory material, (6) strong resistance to both the chemical and physical action of molten slag. For proof we offer the above illustration showing CRYSTOLON Brick still in excellent condition after 12 years of trouble-free service in a school boiler.

NORTON COMPANY - Worcester 6, Mass.

CRYSTOLON—Trade-mark Reg. U. S. Pat. Off.

Boilers by edge moor

Vertical Flow Bent Tube Boiler

This unit is designed for maximum output in a limited space. It is a combination of a simple two-drum boiler bank, having perfect U-tube circulation, and a water-cooled furnace, integral with the boiler. The large amount of surface exposed to radiant heat results in a quick-steaming unit that will give rapid response to load changes. This unit is adaptable to all fuels and is available in all sizes.

This and other types of Edge Moor boilers are available in a wide range of capacities, pressures and accessory equipment. Write for literature today.

EDGE MOOR IRON WORKS, INC. Main Office and Works: Edge Moor, Delaware. Branch Offices and Agents: Atlanta, Boston, Chicago, Detroit, Hoboken, St. Paul, San Antonio and San Francisco.

edge moor steam generating equipment

EM

December 27, 1946

NORDBERG MANUFACTURING COMPANY

of Milwaukee, Wisconsin

Acquired the Manufacturing Assets and Good Will of

BUSCH-SULZER BROS.-DIESEL ENGINE CO.

of St. Louis, Missouri

The reputation of this pioneer American Diesel engine manufacturer will be zealously guarded by the Nordberg Manufacturing Company.

Founded in 1901 by the late Adolphus Busch, the Busch-Sulzer Bros.-Diesel Engine Company built the first Diesel engine in America, following the acquisition by Mr. Busch of the first American manufacturing rights to the Diesel engine from its inventor Rudolf Diesel.

It is with great and mutual pride that both companies announce the continuation of this business as a division of the Nordberg Manufacturing Company, which in recent years has become America's foremost manufacturer of large heavy duty Stationary and Marine type Diesel engines.

Nordberg's present range of Diesel engines will be continued and further expanded to provide the most complete coverage — from 10 HP to 8500 HP — of heavy duty Diesels offered by any American company. Manufacturing, sales and service facilities are being rapidly coordinated to cope with this progressive program enabling Nordberg to supply the ever expanding American and foreign markets.

NORDBERG MACHINERY

NORDBERG

AIR DRIVEN TYPE

MOTOR DRIVEN TYPE

NOW - a fast accurate way to reface HANDHOLE SEATS!

THE NEW ELLIOTT HANDHOLE SEAT GRINDER replaces the old unsatisfactory hand filing and hand-held motor driven grinding methods of refacing handhole seats in boilers, economizers, superheaters or other pressure units. Time saved and precision gained by this new maintenance tool make it a "must" for every boiler room.

Operation of the Elliott Grinder is simple. The unit is easily clamped to a header and the grinding wheel inserted into the handhole. Air or electric power drives the accurately aligned spindle, motion of which is limited to one plane only—and the whole job is completed in a short time. The refaced seat is left smooth and true—to a degree virtually impossible by old hand filing methods.

An added feature of this new Elliott tool is a wire brush, interchangeable with the grinding wheel, which is supplied for cleaning seats which do not require refacing or for pre-refacing cleaning.

PROVEN BY SERVICE

Reports of users in boiler rooms indicate that jobs which formerly took days now are reduced to hours. One man who had taken *an entire day* to reface *one handhole* with a file, completed *fourteen in five hours* with this Elliott Grinder!

Check on your own boiler room refacing methods. Get all the facts about this Elliott Handhole Seat Grinder now and cut outage and manhour losses. Write today.

Y-258

ELLIOTT Company

Lagonda Division, Springfield, O.

Plants at JEANNETTE, PA.—RIDGWAY, PA.
SPRINGFIELD, O.—NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" BRASS CO. *Headquarters for BRASS, BRONZE, and COPPER*

ANTICIPATE FUTURE CONDITIONS

Extending Condenser Tube Life

How are power plant operators meeting the dual challenge to produce more power and meet higher costs? The answer is being sought through higher efficiency.

There are many plants that are using condenser tubes of Admiralty composition installed during the war, and are looking forward to a complete retubing job in the near future. Now they can select the alloy which will stand up under present-day operating conditions, since they are not restricted as to alloy.

Other plants are going ahead with their modernization and expansion programs in spite of unexpectedly high construction costs and substantial price advances in equipment. Worn-out plants are inadequate to handle existing requirements for electric service. Operators foresee good business conditions for years to come and are making plans which will take care of their present and future requirements.

New plants which anticipate future needs should use only condenser tubes which will adequately withstand the more severe operating conditions that are also predicted for the future. As a matter of fact, the best tubes are the cheapest from the standpoint of hours of service obtained from them.

Selecting The Most Serviceable Alloy

It is unwise to assume that an alloy which has given good service in the past will be satisfactory for present and future conditions.

The history of a number of installations has revealed that condensers which were intermittently used over a period of many years performed in a very satisfactory manner, although toward the end of the useful tube life the continuity of operation may have been slowly increasing with rest periods becoming shorter. Replacements with new tubes which were then used for almost continuous service, with very short rest periods, have often led to increased tube failure. It appears that this type of difficulty will continue to be quite prevalent until the time when such a condenser is again used for intermittent service.

If it is necessary to change the condenser from intermittent to continuous operation, it will be necessary to consider a change of condenser tube alloy, since a material which will operate satisfactorily under intermittent service may not necessarily operate satisfactorily under continuous operation.

In some seaboard plants Admiralty has given very satisfactory service when used in an intermittent manner, but has not come up to expectations when pressed for continuous use. Aluminum Brass, however, has given a better account of itself than Admiralty for continuous operation, other conditions being equal.

When selecting condenser tubes, one should take into account the operating changes which have occurred during the period that the present condenser tubing has been in operation. Has there been a change in the intake screen construction? Smaller holes or openings in the screens than in the tubes themselves help to retard the entrance of certain types of foreign matter into the tubes. Has there been less frequent cleaning of tubes? Proper cleaning done regularly will reduce pitting from foreign deposits. Removal of slime will increase heat transfer, hence efficiency. Has there been a change in pump capacity? Increased water velocity accelerates corrosion and may be responsible for impingement attack at the inlet end of the tubes. Has the condenser changed from intermittent to continuous service? Intermittent service often permits the deposit of a tenacious protective scale or film on the inside of the condenser tubes. Hence longer life expressed in number of service hours is to be expected.

Investigate More Corrosion-Resisting Alloys

It doesn't pay to gamble with the selection of condenser tube alloys; hence, Bridgeport Brass Company encourages operators to test, under service conditions, samples of the more corrosion-resistant condenser tubing such as Duronze IV* (arsenical aluminum bronze), Cuzinal (aluminum brass), and Cupro Nickel. This is the soundest kind of procedure before selecting an alloy for retubing. There is no substitute for experience when it comes to condenser tubing. Bridgeport has always realized the importance of corrosion research in connection with rendering best possible service to condenser tube customers, and fully intends to maintain that activity at a high level. Laboratory tests have proved the beneficial effects of alloying elements such as arsenic to Duronze IV and to our Copper-zinc alloys; aluminum and tin to brass; iron to cupro nickel. When such data are correlated with records kept by power plant operators, a great deal of time can be saved by determining which alloys probably will or will not work best under a given set of conditions.

Anticipate Tubing Requirements

The necessity for ordering condenser tubing early has been mentioned before and is important enough to bear repetition.

Operators planning new construction will find it very beneficial to order condenser tubing at the same time they place orders for equipment. If this is done, delays in condenser tube delivery will not hold up completion of the entire job.

There are other advantages in anticipating retubing requirements. By having enough tubing on hand when it is needed, operators can protect themselves against shutdowns due to premature tubing failure, and can schedule retubing operations more efficiently.

Bridgeport's Corrosion Research Laboratory and Technical Service Department are set up to help operators get the most out of their condenser tubing and choose more corrosion-resistant alloys for retubing. Contact them through the nearest Bridgeport Office. Make sure that you have Bridgeport's technical literature on condenser and heat exchanger tubing—the Condenser Tube Manual and Duplex Tubing Technical Bulletin No. 746.

*U. S. Pat. No. 2,093,380

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • *ESTABLISHED 1865*

1. Three-ply, heavy, rubberized fabric envelope applied on bias—to protect load-pulling cord members.
2. Resilient rubber skim coat.
3. Plies of high tensile, parallel cords, individually imbedded in fatigue-resisting rubber, number dependent upon load conditions.

1. Hard, close-woven, rubber-impregnated duck plies—full width, without seam—offer peak load-carrying and fastener-holding strength, with maximum flexibility.
2. Rubber skim between plies affords added flexibility, heat elimination.
3. Friction surfaces on both outer plies permit operation of belt from either side with same high pulley traction.
4. Edges cemented and sealed against moisture, fumes, etc.

1. Elastic envelope takes the wear—transmits loads to the heavy cord section—protects carcass.
2. High tension section.
3. Insulating gum.
4. Heavy cord load-carrying section in neutral plane.
5. Compression section.

RIGHT CONSTRUCTIONS • BEST MATERIALS • • *Republic* TRANSMISSION BELTING

REPUBLIC technologists, exclusively devoted to making rubber serve industry, build superior service into Republic Transmission Belting. Shown here are construction drawings of three popular types in Republic's extensive line . . . a completely diversified line that offers a specially adapted construction for each class of service conditions. With this assurance of quality and specialized serviceability, the remaining step toward peak operating economy and efficiency is proper belt selection for the job. Years ago Republic began a consistent program of technical training for its nationwide network of industrial distributors, to supplement their own practical experience. Your Republic Distributor is eminently qualified to aid in determining the right belting for your needs.

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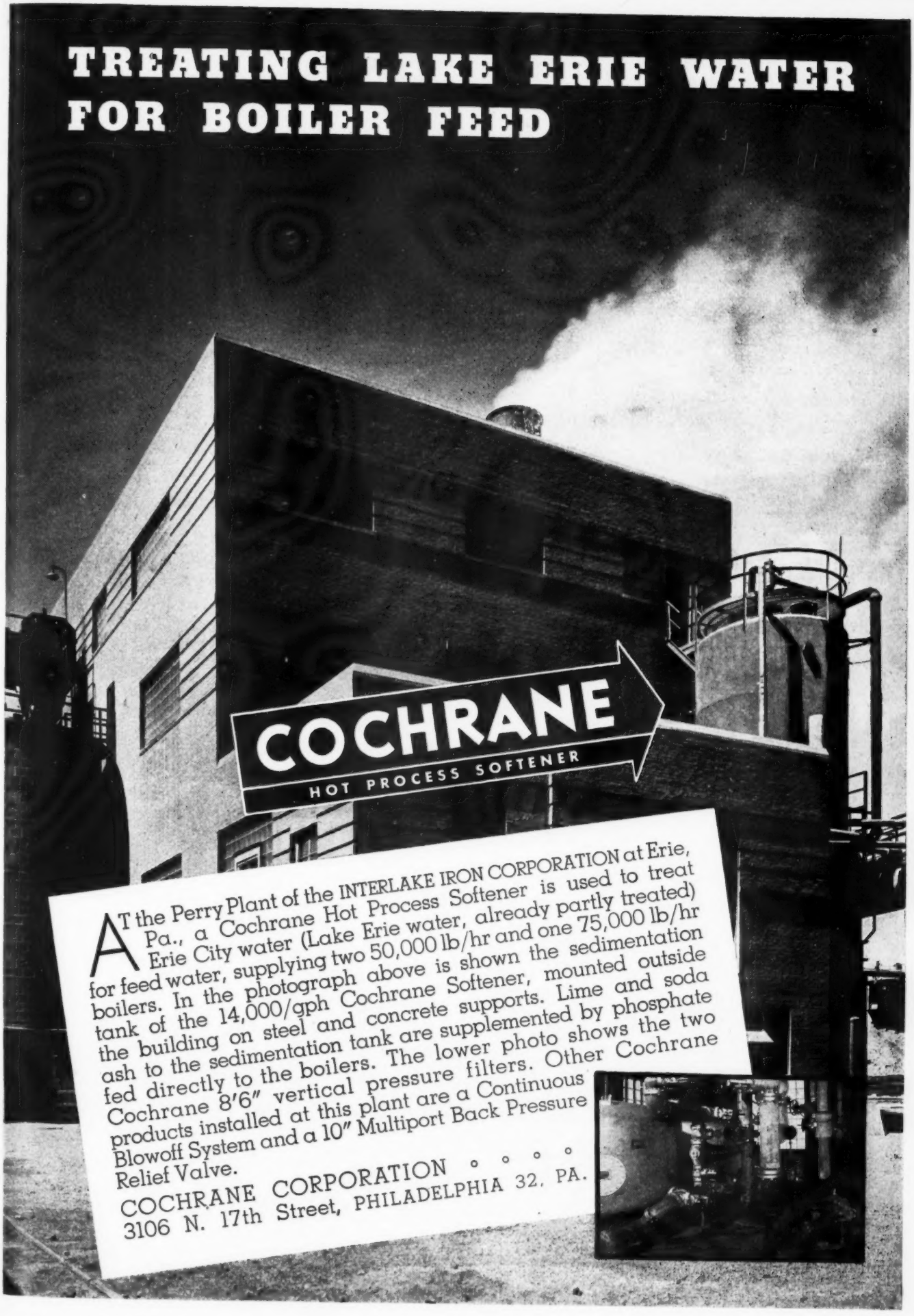
LEE DELUXE TIRES AND TUBES
CONSHOHOCKEN PA

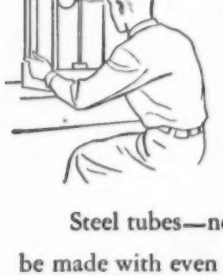
TREATING LAKE ERIE WATER FOR BOILER FEED



AT the Perry Plant of the INTERLAKE IRON CORPORATION at Erie, Pa., a Cochrane Hot Process Softener is used to treat Erie City water (Lake Erie water, already partly treated) for feed water, supplying two 50,000 lb/hr and one 75,000 lb/hr boilers. In the photograph above is shown the sedimentation tank of the 14,000/gph Cochrane Softener, mounted outside the building on steel and concrete supports. Lime and soda ash to the sedimentation tank are supplemented by phosphate fed directly to the boilers. The lower photo shows the two Cochrane 8'6" vertical pressure filters. Other Cochrane products installed at this plant are a Continuous Blowoff System and a 10" Multiport Back Pressure Relief Valve.

COCHRANE CORPORATION ° ° ° °
3106 N. 17th Street, PHILADELPHIA 32, PA.

Both represent craftsmanship in steel



Because the armorers and swordmakers of Spain's Toledo and the Near East's Damascus devoted their lives and their workshops to specialized craftsmanship, the fame of their blades has become immortalized in history.

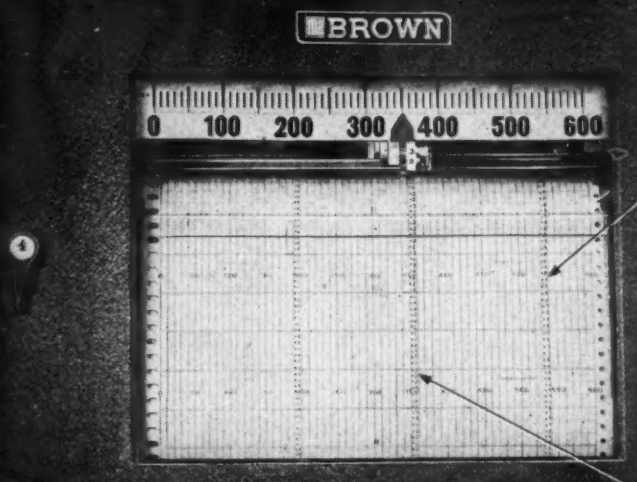
Steel tubes—not so glamorous as sword blades—must be made with even greater care, skill, and uniformity if they are to serve long and dependably in pressure, high temperature, or mechanical applications, as well as where corrosion resistance is required.

Globe Steel Tubes Co., specializing in tubing manufacture, maintains continuous laboratory research to make steel tubes better—to produce tubes of such exceptional uniformity and quality that they represent true "craftsmanship" in steel.

If your needs in steel tubes involve problems — call upon the specialized experience and facilities of Globe. Globe Steel Tubes Co., Milwaukee 4, Wisconsin.

Seamless Tubes—Carbon—Alloy—Stainless Steels; *Globeweld* Welded Stainless Steel Tubing; *Globeiron* High Purity Ingot Iron Seamless Tubes; Mechanical Tubing—Pressure Tubing—Tubing for Corrosion and Heat Resisting Applications.

Invaluable to Power Plant Efficiency



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PREHEATER
CONDENSER
BLEED STEAM
FEED WATER
HOT WELL
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AIR
TURBINE
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SUPERHEATER

ALL RELATED TEMPERATURES RECORDED ON ONE CHART

CENTRAL temperature readings increase power plant efficiency. With all related temperatures on one chart operators *can see overall operations* at a glance instead of referring to a multitude of instruments and attempting to correlate their readings.

The Brown ElectroniK Multiple Record Potentiometer will record 2 to 16 different temperature records on one chart. Operating on the exclusive "Continuous Balance" principle, this instrument employs an electronic detection and balancing unit instead of a galvanometer. This means greater accuracy (± 1/5 of 1% of scale span) and twice the sensitivity of any other instrument on the market.

The Brown ElectroniK Potentiometer is unaffected by vibration. This means the same operating efficiency and neligible maintenance requirements even with the vibration prevalent in most power plants.

For complete information, send for Catalog 15-8.

THE BROWN INSTRUMENT COMPANY, a division of Minneapolis-Honeywell Regulator Company, 4490 Wayne Avenue, Philadelphia 44, Pa. Offices in all principal cities.

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BROWN *Electronik* POTENTIOMETERS

Sure you can Bathe in a Bucket

. . . but today a bathtub is standard equipment, and people are not satisfied with anything less. In boiler water treatment you should not be content with anything less than a complete system of treatment and control. After 60 years' experience solving the many varied and complex problems of boiler water treatment, Bird-Archer believes that it takes *eight operations to achieve correct water treatment.*

1. **A study of all available sources of water supply.**
2. **A plant survey, including flow diagram and study of plant equipment and operation.**
3. **Laboratory service for scientific examination of all samples.**
4. **Development of a complete system of treatment and control.**
5. **Instruction of operating personnel in application of the treatment system and control procedure.**
6. **Furnishing treatment materials where indicated, properly formulated for each individual installation.**
7. **Specification of any equipment necessary.**
8. **Continuous supervision of control, plus regular field checkups.**

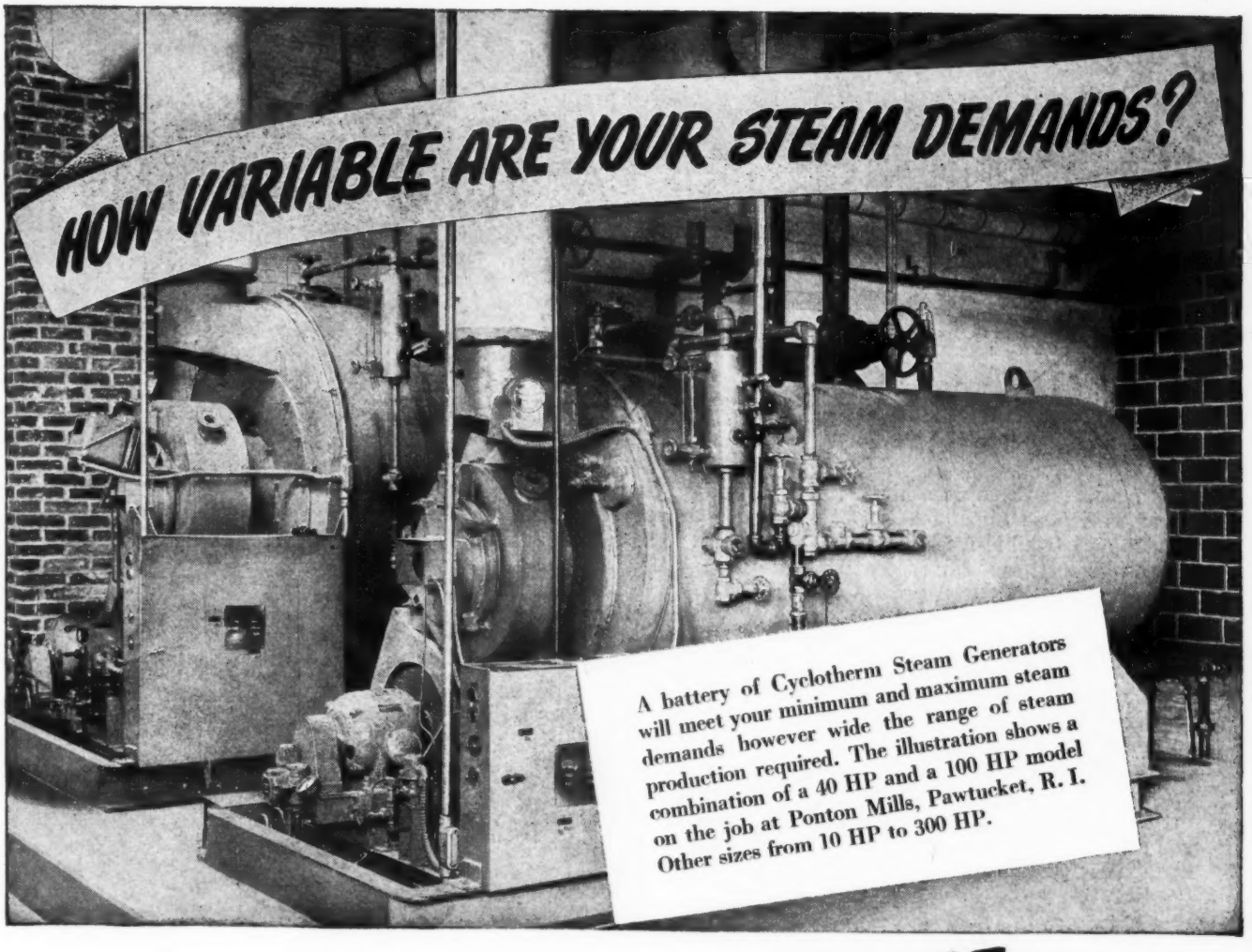
Are **ALL EIGHT OPERATIONS** *being applied in your present Water Treatment System?*

Each is vital to the successful solution of your water treatment problems. Bird-Archer, an organization of Chemists and Engineers—experts in the water treatment field—can offer this complete 8-point service . . . a single responsibility for the solution of your boiler and process water treatment problems.

If you would like to know more about the difference between "buckets and bathtubs" as applied to boiler water treatment systems, drop us a line. Our field engineers will be happy to consult with you without obligation, and to explain in detail why only a complete 8-point boiler water treatment and control system can be adequate.

BIRD·ARCHER

THE BIRD-ARCHER COMPANY • *400 Madison Ave., New York 17, N. Y.*
Philadelphia, Pennsylvania • Chicago, Illinois • Montreal, Canada


HOW VARIABLE ARE YOUR STEAM DEMANDS?
A battery of Cyclotherm Steam Generators will meet your minimum and maximum steam demands however wide the range of steam production required. The illustration shows a combination of a 40 HP and a 100 HP model on the job at Ponton Mills, Pawtucket, R. I. Other sizes from 10 HP to 300 HP.

Cyclotherm steam production may be as *FLEXIBLE* as you want it without sacrificing efficiency or economy

CHECK THESE POINTS THAT MEASURE VALUE AND YOU'LL SEE WHY CYCLOTHERM SHOULD BE YOUR 1st CHOICE

- ☑ ***Simplified Design***—Cyclotherm's exclusive combustion method permits simplified overall design and 2 pass boiler construction. Burner and boiler engineered as an integral unit.
- ☑ ***Performance***—Cyclotherm provides steam automatically as you need it. Overall thermal efficiency will be not less than 80%.
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- ☑ ***Initial Cost***—Cyclotherm units are low in cost; easy and inexpensive to install. Delivered ready to produce steam; require no special foundation.

IT'S YOUR BEST BUY!

Phone, wire or write for full information

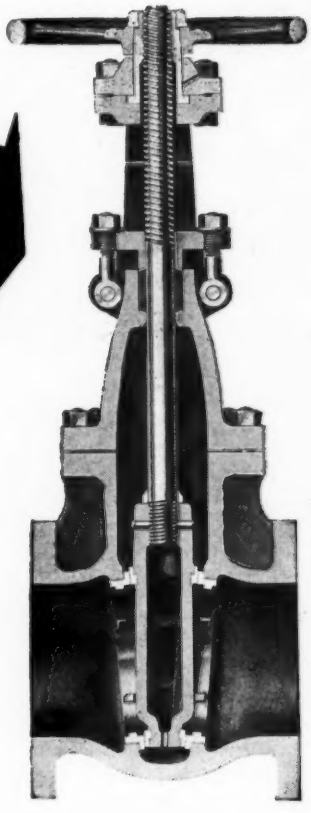
CYCLOTHERM STEAM GENERATORS

CYCLOTHERM CORPORATION, 90 BROAD STREET, BOX 702, NEW YORK 4, N. Y.

Every feature you want in an

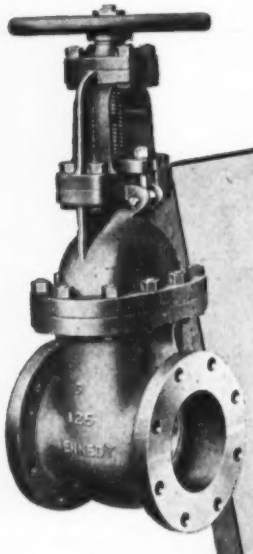
IRON BODY WEDGE GATE VALVE

is in this KENNEDY DESIGN



Whether you examine this Kennedy Standard Iron Body Wedge Gate Valve for basic features that assure ample strength, long service and trouble-free operation, or for refinements that provide extra conveniences and ease of assembly, operation and maintenance, you will find a design that gives you extra values . . . at no extra cost.

Engineers who have tried these valves have become so enthusiastic about their many superiorities that plants all over the country have standardized on them for iron-body wedge gate valve services. These superiorities are fully described in the 240-page Kennedy Catalog, which also shows the entire Kennedy line of bronze and iron body gate, globe, angle and check valves, malleable iron and bronze screwed pipe fittings, and cast iron flanged fittings and flanges. Be sure to write for your copy today . . . you will find it a valuable help in the selection of valves and pipe fittings for your requirements.



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YOU WANT THESE VALVE FEATURES

. . . you'll find them in this KENNEDY design

1. **Generous Strength . . .** Body and bonnet are of high-grade dense metal with ample thickness and rounded fillets. Stem has large diameter and extra large number of contact threads.
2. **Easy Operation . . .** Stem and stem contact surfaces are accurately threaded. Deep stuffing boxes permit tightness without undue pressure on packing. Large handwheel gives firm, comfortable grip.
3. **Lasting Tightness . . .** Discs and seats seat accurately, and their sturdy design resists distortion and has special provisions for take-up of wear.
4. **Long Life . . .** Many Kennedy valves have been in daily use a quarter century and more.
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6. **Economical Maintenance . . .** Long wear built into all parts, and adjustments or other attention are seldom required.

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Elmira, New York

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KENNEDY *valves - pipe fittings - fire hydrants*

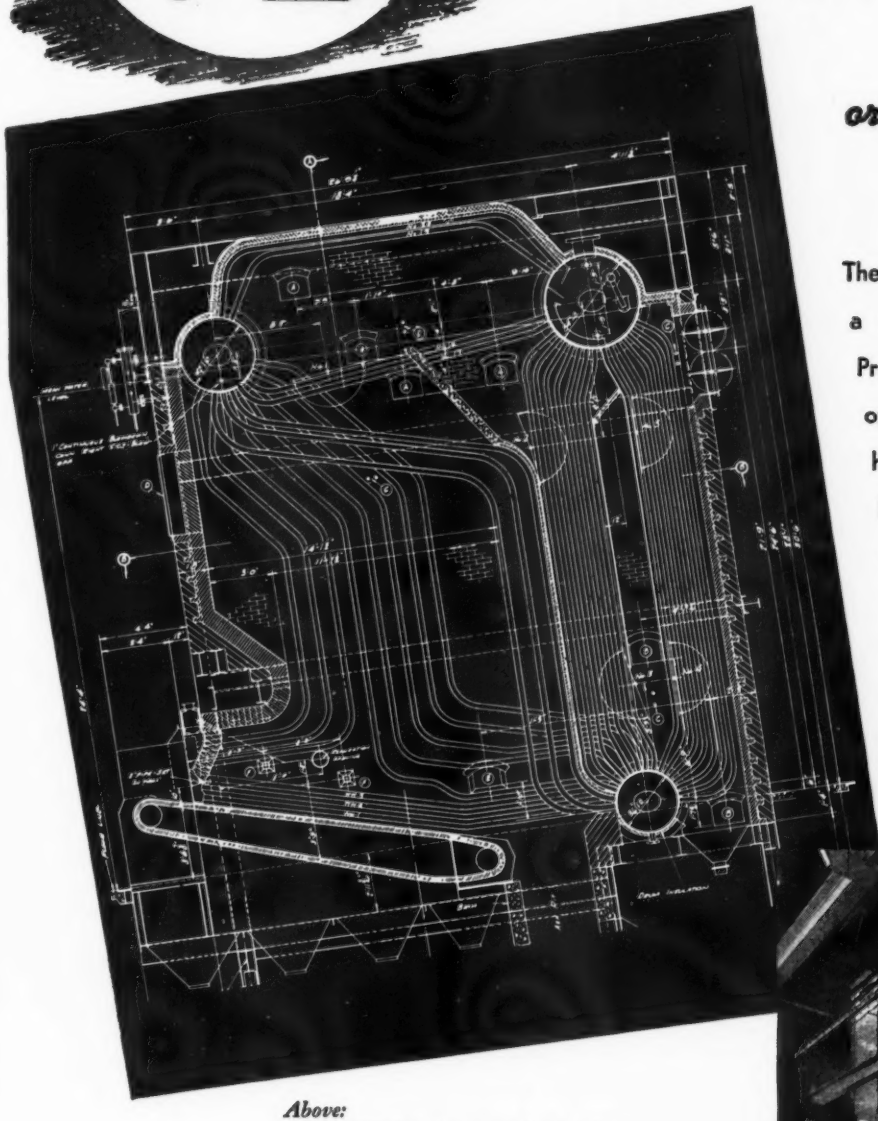
CLASS **VL**

Vogt

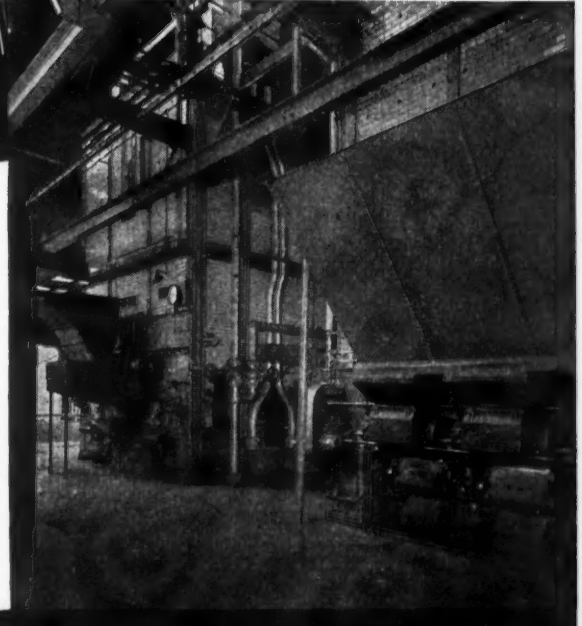
Steam Generating Units

for POWER *or* PROCESSING LOADS, *and* HEATING

The design provides large furnace volume and a high ratio of radiant heating surface. Proper combustion is assured with any fuel or method of firing. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Vogt Class VL Steam generating units are giving satisfactory service in Hotels, Sugar Refineries, Steel Mills, Furniture Factories, Distilleries, Oil Refineries, and related industries. A bulletin showing typical installations will be sent upon request.



Above:
This 90,000 lbs. steam per hour unit, designed for 475 lbs. pressure, serves the Mansfield Tire & Rubber Co., Mansfield, Ohio.



Right:
Two 515 H.P. units installed in Brown-Forman Distillers Corporation, Louisville, Ky. Plant.

HENRY VOGT MACHINE CO. • 1000 W. Ormsby St., Louisville 10, Ky.
Branch Offices: New York, Philadelphia, Cleveland, Chicago, St. Louis, Dallas

The Electrical Maintenance Man KNOWS!

FOR POWER CIRCUITS

ROCKBESTOS A.V.C. 600 VOLT
POWER CABLE — TYPE AVA
(Flexible stranding for motor leads)
Maximum operating temperature 110°C.

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BOILER ROOM WIRE — TYPE AVA
Maximum operating temperature 110°C.

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ROCKBESTOS A.V.C. 600 VOLT
MULTI-CONDUCTOR CONTROL CABLE

Three of 125 different permanently insulated wires and cables designed by Rockbestos for severe or unusual operating conditions.

Few electrical maintenance men who have worked around hot-spot installations very long have to be told which cable can really take it. Once they've seen Rockbestos A.V.C. in troublesome locations they know that it stands up where other types fail and greatly reduces the need for frequent and expensive re-wiring.

The reason Rockbestos A.V.C. wires and cables operate so dependably under unusually severe conditions lies in their *permanent insulation* of impregnated asbestos. They won't bake brittle, crack or flow even at operating temperatures ranging up to 230°F. And they won't deteriorate with age nor rot when exposed to oil, grease or corrosive fumes.

Rockbestos A.V.C. constructions in 600 to 5000 volt ratings include single and multi-conductor power cables, switchboard and lighting wires, control cables and other National Electrical Code types. Write for a catalog, recommendations or samples.

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The Wire with Permanent Insulation

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Our Operations and Products . . .
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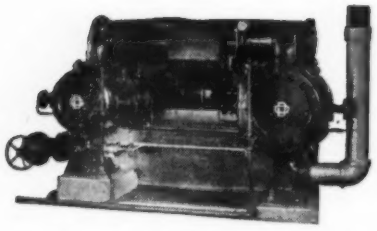
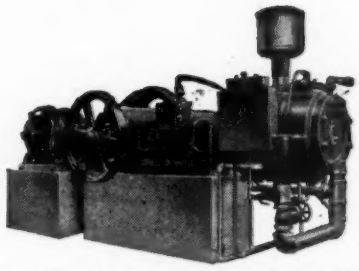
WATCH FOR AN
IMPORTANT
ANNOUNCEMENT
IN THIS
MAGAZINE
DURING MARCH



The air cylinders in this Gardner-Denver "HA" Horizontal Compressor are especially designed for highest volumetric efficiency and lowest horsepower requirements. Its duoplate valves are cushioned for high delivery capacity, high compression efficiency and lowest power consumption. The class "HA" compressors are available in capacities from 316 to 2012 cubic feet displacement per minute.



Is dust a problem in your plant? This Gardner-Denver Class "RX" Horizontal Compressor is dustproof. And its special design permits complete water jacketing of all valves, air passages and cylinder heads to remove the heat of compression—increasing efficiency and cutting horsepower. The Class "RX" Horizontal Compressors are furnished in sizes from 89 to 1292 cubic feet displacement per minute.

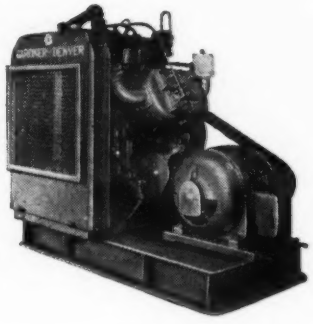
shopping for EXTRA *value?*

To get your money's worth in air compressors, centrifugal pumps or concrete breakers, look for the *special* features that help you do a better job at less cost. Every Gardner-Denver product on this page has such features—and we'll gladly give you complete information about any one of them. Write Gardner-Denver Company, Quincy, Illinois.

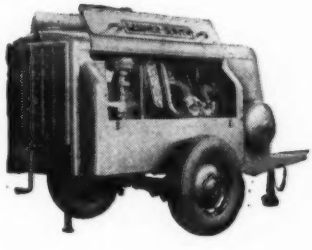
GARDNER-DENVER

SINCE 1859

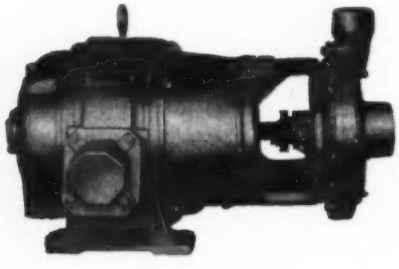
In this Class "WB" 2-stage Vertical Compressor, Gardner-Denver engineers departed from conventional air compressor design to give you more volumetric efficiency with greater capacity. "WB" Compressors—furnished in capacities from 142 to 445 cubic feet displacement per minute—have efficiencies comparable to those of large horizontal compressors.



Here's a modern portable air compressor that's mighty handy to have around the plant! Complete water jacketing of its cylinders means dependable operation under constant load—cooler air—lubricating oil economy. Gardner-Denver "Portables" are furnished in sizes to suit every need.

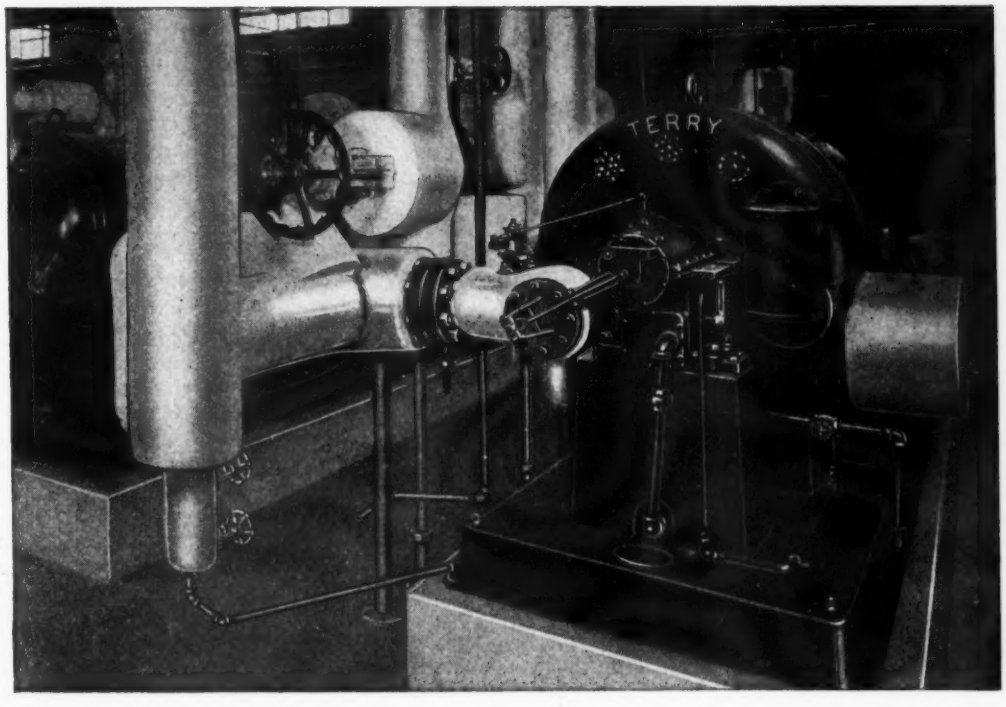


In this Gardner-Denver Close Coupled Centrifugal, see how pump and motor are combined to form a complete, compact unit. These pumps can be installed in any position and are designed for capacities up to 250 gallons per minute, and heads up to 250 feet.



Plant alterations go forward more quickly when your men use this new Gardner-Denver Paving Breaker. The B87 is easier to handle than conventional types—and has a special safety latch which prevents air throttle from being opened when it is moved from place to place. Easily convertible to a sheeting driver.

TERRY



GENEROUS BLADE CLEARANCES IN THIS 900° TERRY WHEEL TURBINE INCREASE DEPENDABILITY . . . .

The 290 H. P. Terry Turbine shown above is used for Boiler Feed Pump Drive in a recently completed central station. It operates with steam at 850 lbs.-900° F. and employs a Terry one piece wheel, as illustrated at the left.

The blades of this Turbine have large radial and axial clearances. They are further protected by projecting rims at the sides of the wheel. These rims would take without damage any rubbing that might occur if the radial clearance became reduced. It is therefore impossible for the blades to foul.

The side clearance is very large - one inch - so that end play can do no damage.

Such construction makes for dependable operation.
- Descriptive bulletins sent on request. Ask for S-116.

T-1167

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complete boiler tube service
BOILER TUBE CO. OF AMERICA
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PITTSBURGH • CHICAGO
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2

Here are the up-to-date facts and figures you need for

designing more efficient heating and air conditioning systems

FOR five previous editions this book had been the indispensable guide for thousands of heating and ventilating engineers. "No mechanic or air conditioning engineer can afford to be without it," said the Western Plumbing & Heating Journal when the earlier revision was published. Now, once again thoroughly revised and modernized, this new sixth edition supplies you with all the essential information on the proper selection and design of heating and air conditioning systems for all types of buildings, and to suit a wide variety of purposes. It contains much new, helpful material dealing with wartime and postwar developments.

This new manual brings you latest data on:

—radiant heating
—reversed cycle refrigeration
—odor removal
—etc.

Newly revised 6th edition

Just Published

Heating and Air Conditioning

By John R. Allen, Late Past President American Society of Heating and Ventilating Engineers; James H. Walker, Vice President, Detroit Edison Co.; and John W. James, Research Engineer, Iron Fireman Manufacturing Co., and formerly Technical Secretary, American Society of Heating and Ventilating Engineers. 667 pages, 6x9, 330 illustrations, $5.50.

IN accurate, practical detail this manual takes up heating and air conditioning systems for residences, factories, office buildings, theaters, churches, auditoriums, and other buildings. The theory underlying heating and air conditioning engineering is clearly discussed and the development of working methods of design plainly covered. Many detailed charts and tables are included to make the volume a useful handbook for the designing engineer and architect. Various systems are described and contrasted, and the advantages of each for specific purposes treated fully.

23 chapters give you complete, up-to-date coverage. Some phases treated in detail include:

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—apparatus using activated carbon to remove odors
—flue gas efficiency data showing adjustments required to obtain maximum efficiency with coal, gas and oil firing
—theoretical and practical views of the principle of a reversed cycle refrigeration system
—developments in the application of absorption refrigeration to an air conditioner
—use of ultra violet light and tri-ethylene glycol in air sterilization
—improvements in hot water heating, particularly as they affect the design of small forced circulation systems
—latest rating formulae and design procedures for warm-air furnace heating and residential air conditioning

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. . . if so, assure oil withdrawal in coldest weather with a G-FIN TANK OIL HEATER

Note These Advantages of the G-R G-FIN Tank Oil Heater

GREATEST HEATING EFFECTIVENESS . . . provided by the G-FIN elements which have six to eight times the heating surface of bare tubes

MOST COMPACT UNIT . . . fewer tubes and shorter shell for a given duty

LEAST PRESSURE DROP . . . has maximum free area and straight-through flow of oil

NO STRATIFICATION OR VAPOR BINDING . . . oil outlet at top of shell prevents dead pocket

USES LESS STEAM . . . heats oil only locally at point of withdrawal

FEWER TUBE JOINTS . . . resulting from small number of required heating elements

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NO TEMPERATURE STRAINS . . . the U-bend elements are free to expand or contract

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Users report that even in sub-zero temperature, or where oil has partly solidified through long periods of storage, these highly effective heaters assure a steady flow of oil soon after steam has been turned on.

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Write for Bulletin 1641 describing these units in detail.

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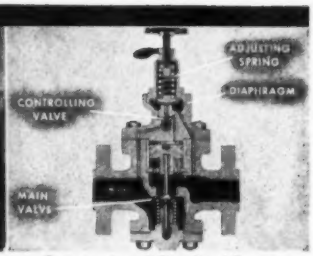

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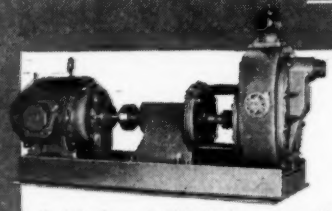

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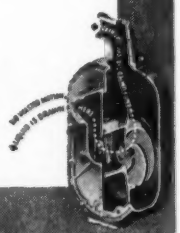

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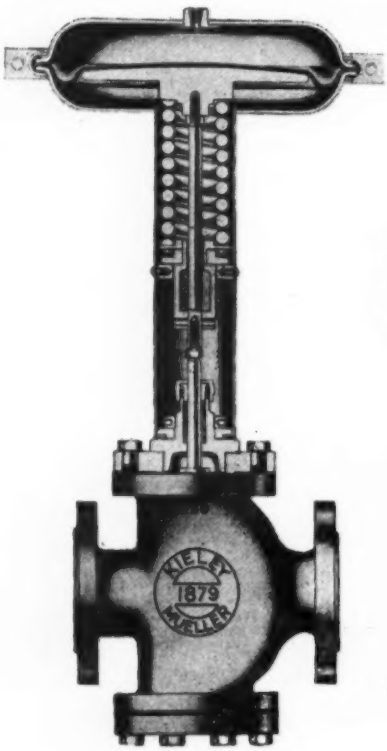

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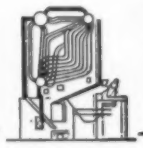

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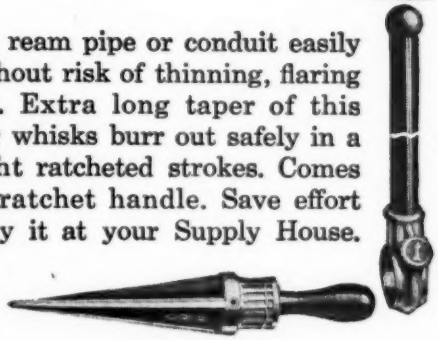

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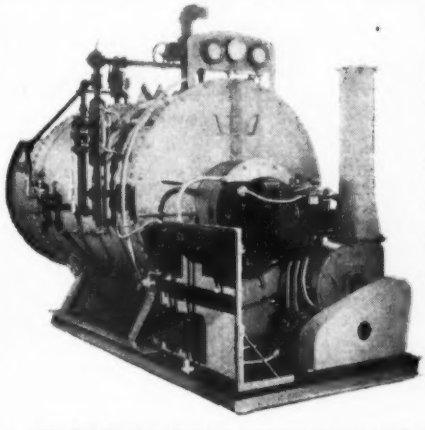

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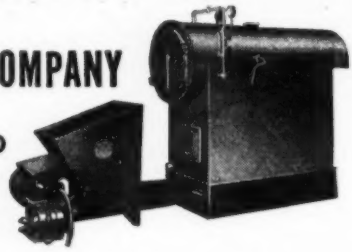

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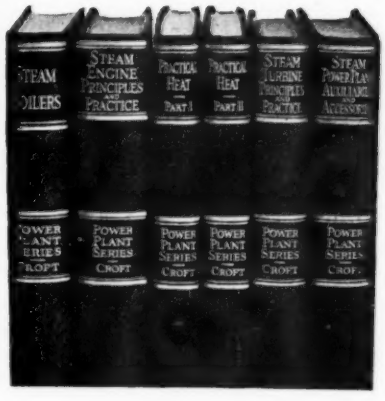
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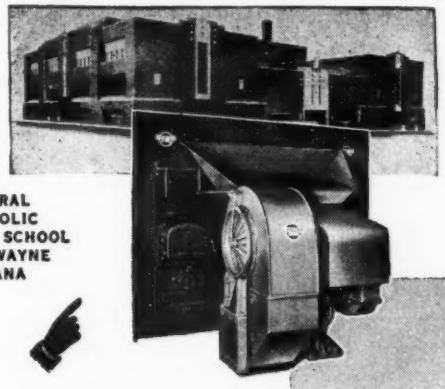

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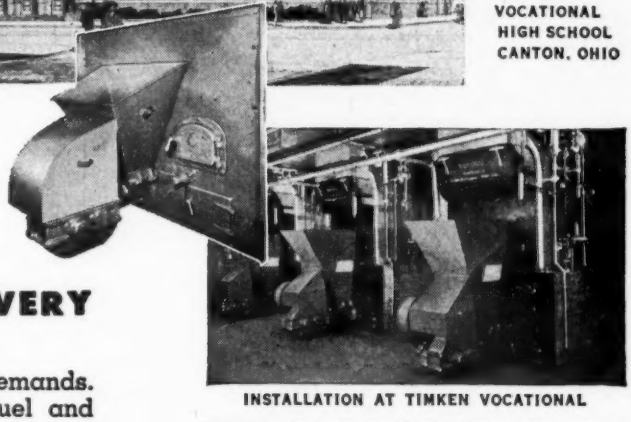

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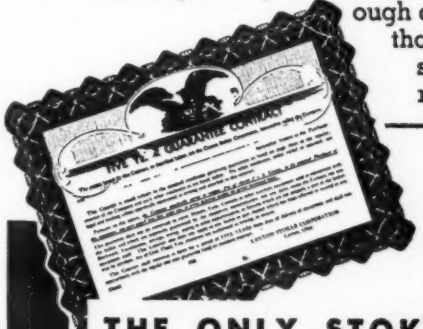
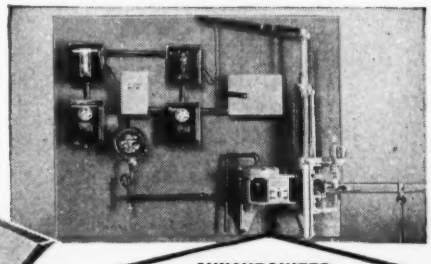
Rugged construction meets severe service demands. Firing efficiency saves many dollars in fuel and manpower. Canton Stokers are literally engineered for each specific job. You can be certain after thorough analysis of your need, that the Canton model selected will meet all requirements.





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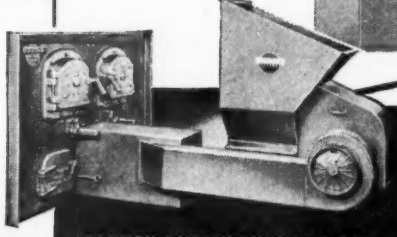

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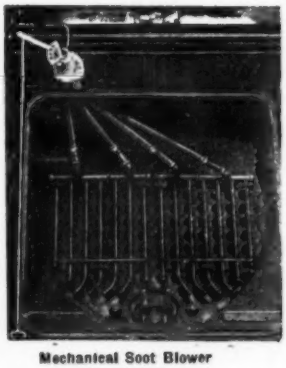

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Deaerating and Non-Deaerating

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TUBE EXPANDERS

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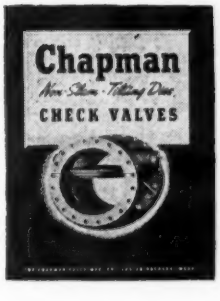

CHAPMAN NON-SLAM CUSHIONED CLOSING CHECK VALVES

THE CHAPMAN VALVE MFG. CO. INDIAN ORCHARD, MASS.

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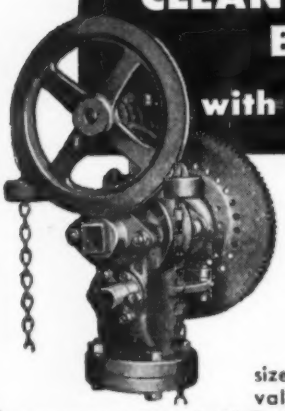

● Increase your power plant efficiency at low cost—install Marion Soot Blowers! Type "F", illustrated, removes soot and ash deposits completely from water tube boilers of any type or size. It is equipped with automatic valve, balanced, chain-driven gear-operated head with flexible mounting to accommodate shifting of tube and wall positions due to heat changes.

Elements, in approved material for temperature and corrosive conditions, are adjustable 3" lengthwise for nozzle alignment. Internally welded nozzles have full Venturi opening to spread steam for deep penetration without pitting tubes. Blowing range quickly adjustable from 45 to 345 degree arc in increments of 6½ degrees.

Valve opening requires 10 to 20 lbs. chain pull, then "free wheels" at 3 to 5 lbs. All parts are interchangeable. Installation is simple and balanced valve is accessible for inspection or regrinding. Made for any usual working pressure. Operated with air or steam. Products of 40 years' manufacturing experience.

Write for Catalog F-45 describing all types of Marion Soot Blowers

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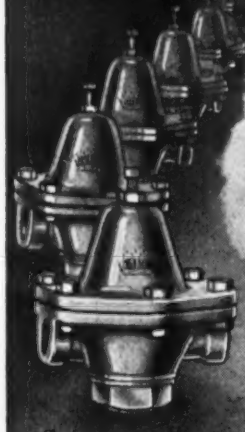

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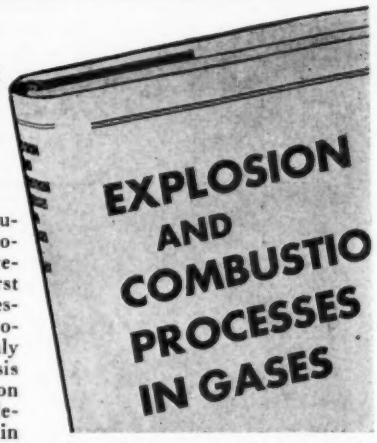

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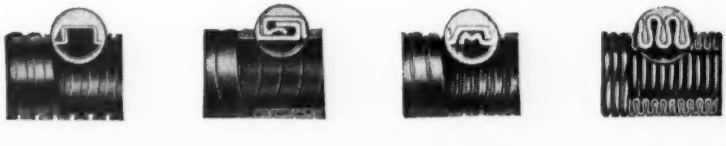

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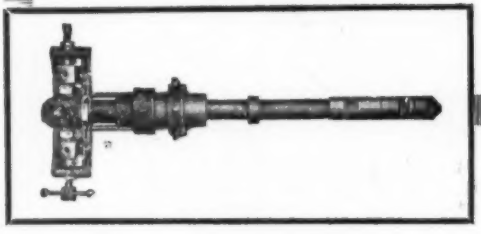

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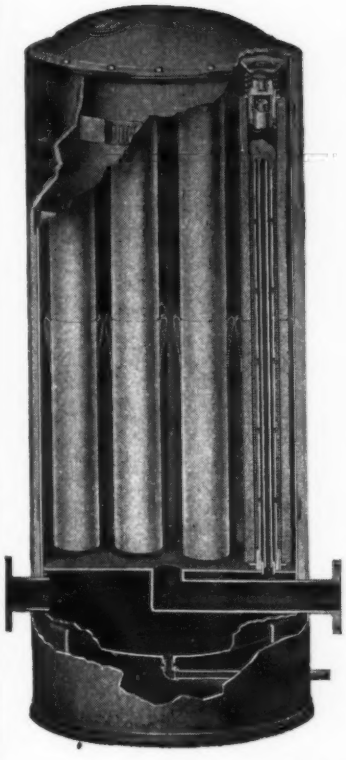

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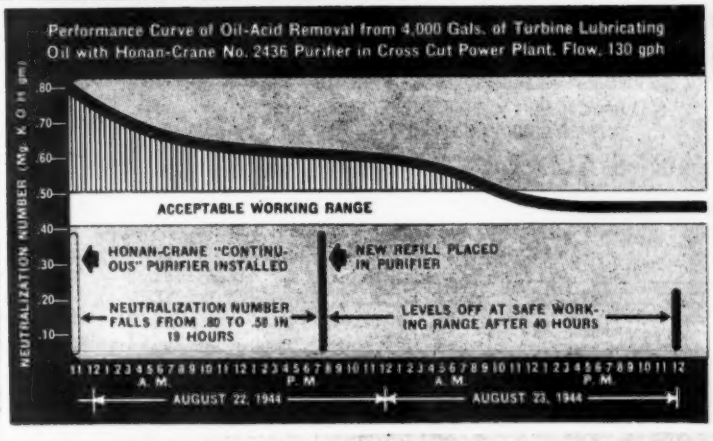
Performance Curve of Oil-Acid Removal from 4,000 Gals. of Turbine Lubricating Oil with Honan-Crane No. 2436 Purifier in Cross Cut Power Plant. Flow, 130 gph
NEUTRALIZATION NUMBER (Mg. K O H gm)
.80
.70
.60
.50
.40
.30
.20
.10
ACCEPTABLE WORKING RANGE
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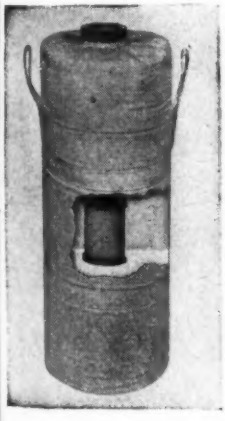
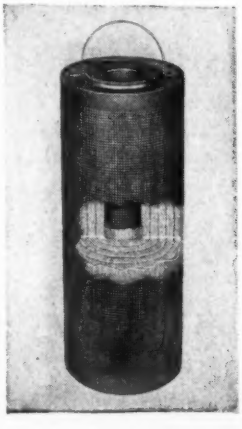


"MC" CARTRIDGE FOR "M" TYPE PURIFIERS

Contains 13 lbs. Cranite (specially processed fuller's earth). Recommended where a complete job of purification is desired. Will remove solids, abrasives, acids, sludges and all other types of contamination.



"MF" CARTRIDGE FOR "M" TYPE PURIFIERS

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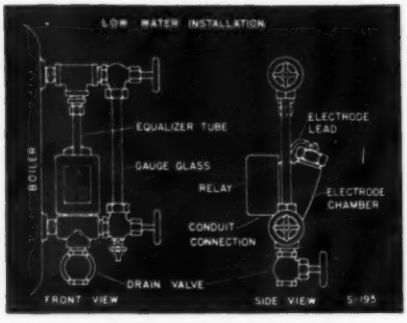

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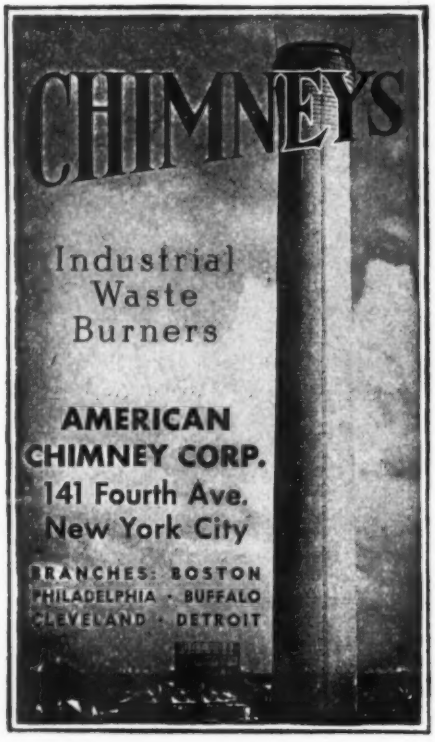

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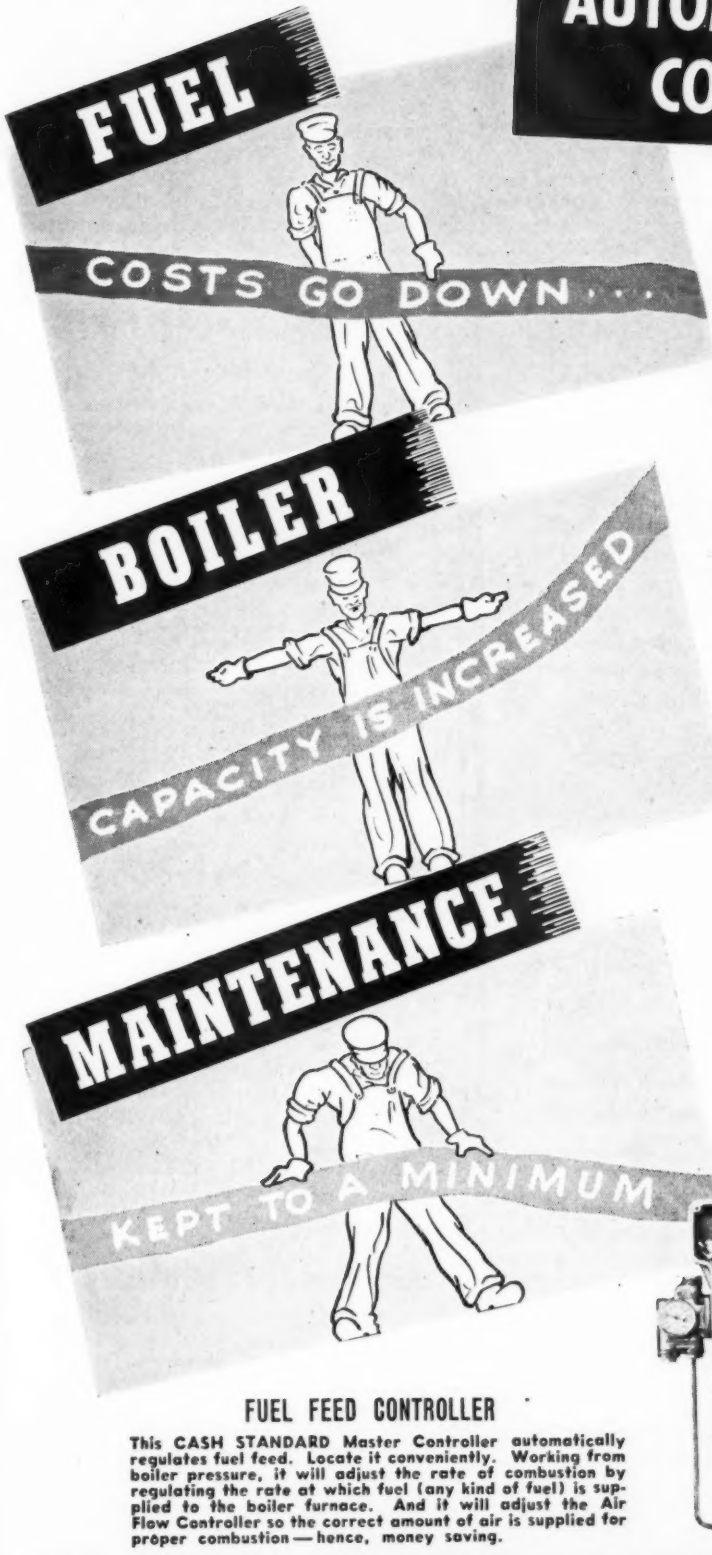

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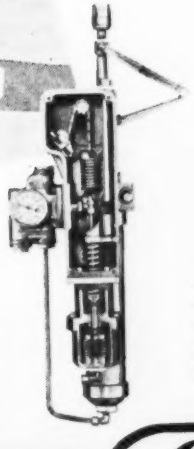
This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

FUEL FEED CONTROLLER



This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD
CONTROLS . . VALVES

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:
(Not available for equipment advertising) 90 cents per line, minimum 4 lines. To figure advance payment count 6 average words as a line and allow 10 words for a publication box number address.
POSITIONS WANTED (full or part-time individual salaried employment only), ½ the above rates.
PROPOSALS, 75 cents a line insertion.

INFORMATION
BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:
This advertising rate is $8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns—30 inches—to a page

NEW ADVERTISEMENTS received by February 11th will appear in the March issue, subject to limitation of space available

POSITIONS VACANT

ELECTRICAL ENGINEERS experienced in design of substations, power plants or overhead and underground distribution systems. Desirable living conditions in fine home community. Write to Electrical Engineer, Pennsylvania Power & Light Co., Allentown, Pa.

MECHANICAL ENGINEER Wanted: several years experience in Power Plant Maintenance and operation; age 30 to 40; Pacific Southwest; permanent; expanding community. Address replies to P-249, Power, 68 Post Street, San Francisco 4, Cal.

EMPLOYMENT SERVICES

SALARIED POSITION $2,500 - $25,000. This thoroughly organized confidential service of 37 years recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000 - $25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jyra Thayer Jennings, Dept. G, 109 Church Street, New Haven, Conn.

POSITIONS WANTED

MASTER-MECHANIC. Completing 12 years service as such as 180,000 KW. steam power plant; active, energetic, capable, excellent recommendations no bad habits; has wife and 2 children; good manager, now has force of 30 men; wants permanent location, pref. in W. part of U. S. PW-229, Power, 68 Post St., San Francisco 4, Calif.

MARINE ENGINEER, 30 years of age. Married. B.S. in Marine and Electrical Engineering (applied), desires opportunity in power field. Seven years varied engineering experience ashore and at sea, with past two years as Chief Engineer in Navy (Lt. Comdr.) and Merchant Marine. PW-250, Power, 330 W. 42nd St., New York 18, N. Y.

ELECTRICAL ENGINEER B.S. (E.E.) 32, married. 6½ years experience in heavy industry supervising installation, operation and maintenance of equipment. Know industrial electronics and design. Have taught radio designs, D.C. & A.C. Theory and Machinery. Good general knowledge of men and machines. Location in West or Pacific Southwest preferred but will consider other locales. PW-251, Power, 520 N. Michigan Ave., Chicago 11, Ill.

POWER PLANT Engineer—Experienced in overall supervision of modern steam plants—18 years broad experience in operation and maintenance of power plant equipment, labor relations, job rating, training programs and general progressive administration—technical training—age 45. PW-252, Power, 330 W. 42nd St., New York 18, N. Y.

AVAILABLE

under contract

POWER PLANT SUPERINTENDENT, 40 years experience operating, servicing and erecting all kinds of modern equipment. Considered as factory expert on inspection and servicing steam turbines, boilers, condensers, evaporators, pumps, etc. At present employed as superintendent of two plants, where over $100,000 annually has been saved in the operating cost through changes and education of the operating personnel, all accomplished within one and one-half year after taking over the management. You too can profit from my experience.

Connection must be with large company burning at least 10,000 tons of coal or equivalent per month. Capable of advising on new plant changes to modernize.

PW-237, Power
520 North Michigan Ave., Chicago 11, Ill.

DRAFTSMEN

DESIGNERS AND CHECKERS
with experience on
Structural Steel and Concrete
Process Piping
Pressure Vessels

The Boston office of E. B. Badger and Sons Co., internationally famous chemical engineering organization, offers qualified men well-paying positions. This is a fine opportunity for men who would enjoy working in congenial surroundings and with pleasant cooperative associates. A personal interview can be arranged in your city. This is not a temporary position. Write, giving full details of background and experience, salary wanted, etc., to

Mr. William M. Rose, Personnel Director
E. B. Badger and Sons Co.
75 Pitts Street, Boston, Mass.

WANTED

MECHANICAL ENGINEER

Experienced in design and calculation of tubular Heat Exchangers used in industrial plants, etc. Good opportunity with well known manufacturer in upper New York State. Write giving age, experience, expected salary, etc. to

P-254, Power
330 West 42nd St., New York 18, N. Y.

Checker Of Pressure Vessels

Qualified to check and figure boiler drums, headers and piping—thoroughly acquainted with A.S.M.E. Power Boiler Code. Central New England location.

P-247, Power
330 West 42nd St., New York 18, N. Y.

WANTED

STRUCTURAL ENGINEER

For Design Of Structural Steel and Reinforced Concrete Structures

WESTCOTT & MAPES, INC.
New Haven, Connecticut

WANTED

MECHANICAL DRAFTSMEN

Experienced In

High and Low Pressure Piping For Power Plants and Industrial Plants

Also

Experienced Heating and Ventilating Draftsmen

WESTCOTT & MAPES, INC.
New Haven, Connecticut

WANTED

SALES HEATING ENGINEER

to take complete charge of design and manufacture of pipe hangers and supports and expansion joints, must be familiar with problems of piping relative to expansion, contraction, pressure, vibration and load. Location at Boston or New York.

P-246, Power
330 West 42nd St., New York 18, N. Y.

SALES MANAGER

Division of Midwest AAA manufacturer. Experienced in Power piping field as sales engineer. Engineering graduate, 35-50. Excellent opening in progressive concern. Give summary experience, references and salary desired.

P-242, Power
330 West 42nd St., New York 18, N. Y.

WANTED

Sales Representatives

A few good territories are available for ambitious men to sell boiler water treatment, fuel oil treatment, soot remover, etc. Our established line includes other excellent industrial products. Our representatives know of this advertisement. Reply stating experience and qualifications.

RW-253, Power
330 West 42nd St., New York 18, N. Y.

WANTED

ADVERTISING

See Page 318

THIS JLHCo OK *on the equipment you buy means*

used equipment-rebuilt and tested by our electrical engineers — to N. I. S. A. standards

MOTOR GENERATOR SETS

1—300 KW. General Electric, type MPC, 125/250 volt, 1200 RPM. direct connected to 1—500 H.P. Ideal 1200 RPM. synchronous 4150 volt, 3 phase, 60 cycle, with direct connected exciter and control.
1—125 K.W. Crocker-Wheeler 125 V. Sq. Cg. 2300 V. 3 phase, 1200 RPM.
1—100 K.W. Electric Machinery, 125 volt, synchronous motor, 4150 volt, 3 phase, 1200 RPM.
1—100 K.W. General Electric, 230 volt, squirrel cage, 440 volt, 3 phase, 1200 RPM.
6—17 K.W. Allis-Chalmers 3 unit 125 V. Sq. Cg. 220 V. 1800 RPM.

ENGINE GENERATOR SETS

1—150 KVA. G.E. Ames Unaflow Engine, non-condensing.
1—120 K.W. Gasoline driven G.E. with Van Bierck Engine.

TURBO GENERATORS

1—600 KW. Terry dual bleeder condensing Turbine only.
1—300 K.W. General Electric, 3 phase, 60 cycle, 220 volt cond.
1— 30 K.W. 125 volt Allis-Chalmers non-cond.

TRANSFORMERS

1—1000 KVA. Auto Transf. 4150 V. 3 Ph. 4 wire to 2406 V. 2 Ph.
3—100 KVA. Westinghouse 11430/250 volt.
2—100 KVA. General Electric 13200/250 volt.
2—100 KVA. General Electric, 2300 volt, 110/220.
2— 50 KVA. Pittsburgh 7500/15000 V. 110/220 v.
2— 50 KVA. Pittsburgh 4000 volt, 110/220.
1— 50 KVA. General Electric, 2300 volt, 120/240.
20—Brand new General Electric air-cooled 440/220 volt primary, 220/110 secondary.
20—Brand new ditto only 220 volt primary, 220/110 secondary.
1— 15 KVA. Pittsburgh 4000 volt, 110/220 secondary.

ALTERNATORS

1—500 K.W. 3600 RPM. 600 volt, Geeneral Electric D.C. exciter.
1—200 KVA. 3600 RPM. 240 volt, Allis-Chalmers D.C. exciter.
1—180 K.W. 514 RPM. 550 volt, Westinghouse .
1—165 K.W. 514 RPM. 2400 volt, Electric Mach.
112 KVA. type TS, General Electric, 900 RPM. 220 volt.
1— 20 K.W. General Electric, ATB, 720 RPM., 2200 volt, 3 phase, 60 cycle.
1—62½ K.W. 3600 RPM. 230 volt, Allis-Chalmers.
1—40 K.W. 1800 RPM. 550 volt, General Electric.
1—35 K.W. 1200 RPM. 240 volt, Columbia Electric D.C. exciter.
1—31.3 KVA. 1200 RPM. 120/280 volt, American D.C. exciter.
1—12.5 KVA. 1200 RPM. 240 volt, Westinghousee, D.C. exciter.

MOTORS—VARIABLE SPEED

230 VOLT

2—200 H.P. 425/212 RPM. General Electric MPC.
1— 40 H.P. 755/1000 RPM. Sprague LC.
1— 30 H.P. 400/120 RPM. General Electric RC-204.
1— 25 H.P. 650/2200 RPM. Westinghouse SK1110L.
1— 25 H.P. 500/1500 RPM. General Electric RF-12.
1— 25 H.P. 400/1200 RPM. Westinghouse SK.
2— 25 H.P. 300/900 RPM. Electro Dynamic.
1— 15 H.P. 300/1200 RPM. General Electric RLC-2024.
1—13/18 H.P. 350/1200 RPM. Electro Dynamic.
3—11½ H.P. 500/1500 RPM. Westinghousee.
1—7½/10 H.P. 500/1500 RPM. Reliance.
1—6/7.5 H.P. 450/1800 RPM. Crocker Wheeler CMC.
1—5 H.P. 500/1500 RPM. Reliance.
1—5 H.P. 600/1200 RPM. General Electric LC.
1—5 H.P. 450/1800 RPM. Crocker-Wheeler CM.
1—5 H.P. 400/1600 RPM. Diehl K6.
1—5 H.P. 225/900 RPM. Electro-Dynamic.

MOTORS 3 PHASE 60 CYCLE

SLIP RING

1—500 H.P. 500 RPM. Lincoln 440 volt.
1—350 H.P. 290 RPM.General Electric MT-424 440-volt.
1—225 H.P. 1800 RPM. General Electric 1-L 220 volt.
1— 75 H.P. 900 RPM. General Electric ITC 220 volt.
1— 40 H.P. 1150 RPM. Cont. Electric SA85 220 volt.
1— 40 H.P. 1130 RPM. General Electric Mt. 2200 volt.

MOTORS 3 PHASE 60 CYCLE

SQUIRREL CAGE

1—450 H.P. 900 RPM. Ridgway, 2200 volt, 3 phase, 60 cycle.
1— 75 H.P. 720 RPM. Crocker Wheeler 550 volt.
2— 50 H.P. 900 RPM. Fairbanks-Morse H, 220 volt.

D. C. GENERATORS

1—300 K.W. 250 V. G.E. MPC 1000 RPM.
1— 75 K.W. 250 V., Westinghouse 260 RPM.
1— 50 K.W. 115 V. Westinghouse 1200 RPM.
2—31.2 K.W. 125 V. Westinghouse 1400 RPM.
2—20 K.W. 50 V. G.E. 1800 RPM.

MOTORS D. C.

230 VOLT

2—450 H.P. General Electric MPL 250 volt, 400 RPM.
1—250 H.P. 750 RPM. Electro Dynamic 230 volt.
1—125 H.P. 1725 RPM. General Electric RC-230-volt.
1— 75 H.P. 575 RPM. General Electric C230 volt.
2— 50 H.P. 700 RPM. Crocker-Wheeler CM 230 volt.
2— 30 H.P. 1150 RPM. General Electric RC-31 230 volt.
1— 30 H.P. 1100 RPM General Electric RC-12 230 volt.
1— 30 H.P. 750 RPM. General Electric RC-14 230 volt.
1— 30 H.P. 625 RPM. General Electric C 230 volt.
1— 25 H.P. 600 RPM. Westinghouse SK 230 volt.
1— 20 H.P. 800 RPM. General Electric RC 12 230 volt.
1— 15 H.P. 350 RPM. Diehl G-312 230 volt.

SYNCHRONOUS MOTORS

1—500 KVA. G.E. 900 RPM. ATI 4150 V. D.C. exciter.
2—160 H.P. Elec.Mach. 1800 RPM. 220 V.D.C. exciter.
1—100 H.P. G.E. type TS, 600 RPM. 440 volt D.C. Exciter.
1— 75 H.P. 1200 RPM. ATI 220 V. 3 phase.
1— 50 H.P. G.E. 1800 RPM. TS 220 V.
1— 50 H.P. G.E. 1800 RPM. ATI 220 V. D.C. exciter.
1— 35 KVA. G.E. 1200 RPM. ATI 2200 V. D.C. exciter
1— 20 H.P. Westinghouse 1800 RPM. 220 V. .8 P.F.

FREQUENCY CHANGERS

1—7½ K.W. 15 KVA. 50% P.F. 1800 RPM. 215 V. 270 Cy. C.W. Westinghouse.
2—15 K.W. G.E. Type MM. 270 cy.

VERTICAL MOTORS

1—75 G.E. Vert. Solid Shaft 1200 RPM. 220 S.R.
1—60 Westinghouse Solid Shaft 900 RPM. 2200 S.R.

MISCELLANEOUS

2—2100 Gallon Pumps Dayton-Dowd 100 foot head.

JLHCo

THIS SEAL IS YOUR GUARANTEE

"FOR POWER"

J. L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

D. C. MOTORS AND GENERATORS

1 YEAR GUARANTEE

125 V. - 250 V. - 550 V. D.C. GENERATORS
(Motor Driven and Belted)

KW	Make	Voltage	Ampere	Speed
500	G.E.	600	833	720
300	Al. Ch.	250/125	1200	1200
250	G.E.	125	2000	390
200	West.	250	800	900
200	Cr. Wh	550	363	900
150	G.E.	250	600	580
150	Ideal	250	600	900
100	G.E.	250	400	900
100	G.E.	125	800	1150
100	Delco (2)	250/125	400	1150
75	Cr. Wh.	125	600	1150
60	West.	125	480	1800
60	G.E.	125	480	900
40	G.E. (8)	250	160	1150
40	Century	125	320	1450
40	West.	250/125	160	1500
40	G.E.	250	160	800
25	Allen	110	320	500
30	G.E. (3)	250	120	1750
20	Delco	125	160	1200
20	West. (6)	125	120	1200
20	Cel. (3)	125	160	1750
20	G.E.	125	160	400
15	West.	125	120	1750
15	Roth	125	120	900
15	West.	230	60	1450
15	G.E.	125	120	1150
15	Scott	110	136	500
15	G.E. (3)	125	120	850
12½	F.M.	125	100	1450
10	Rogers (2)	125	80	1450
10	El. Dy.	125	80	600
8	G.E. (2)	125	64	1800
7½	G.E.	125	60	1800
5	G.E. (2)	125	40	1740
5	Rel.	250	20	1725

80—Additional generators—125 V. up to 2000 V. generators in stock.

LOW VOLTAGE D.C. GENERATORS

KW	Make	Voltage	Ampere	Speed
1-6/1	Hertner	80	20	1800
75	G.E.	75	1000	1145
22½	West.	75	300	720
24	G.E.	60	400	1800
1-1/8	G.E.	60	19	1800
3	Hertner	60	60	1730
40	G.E. (6)	50	800	1160
3/4	H.C.	46	11½	1750
8½	G.E. (3)	42	205	1800
5	Diehl	40	125	1750
33	G.E.	33	1000	850
6½	G.E. (2)	32	205	1800
2½	Witte	32	75	1800
3	G.E.	30	100	1200
48	West.	30	1600	600
6	Star (2)	25	250	1800
5	Star	25	200	1750
15	Rel.	24	625	1450
4	Star	20	200	1800
1	G.E.	20	15	1800
106	El. Pr.	18 36	6000 3000	600
1	West.	16	60	1750
22½	Star	15	1500	1200
15	G.E.	15	1000	1200
11	Star	15	750	1200
1	Cont. (2)	15	67	1750
4½	tar	15	300	1800
30	Columbia	8-16	5000/2500	720
12	H.V.W.	12/24	1000/500	900
7½	Eddy	5/10	1500/750	860

300—Additional low voltage generators in stock.

D.C. MOTOR DRIVEN A.C. GENERATORS

31 KVA Ideal 3 phase output driven by 40 H.P. 115 V. D.C. motor.

25 KW Electric Machinery 3 phase output driven by 40 H.P. 230 V. D.C. motor.

7½ KVA Star single phase output driven by 125 volt D.C. motor.

5 KVA Electric Specialty single phase output driven by 115 V. D.C. motor.

2¼ KW Diehl single phase output driven by 110 volt D.C. motor.

1—KW Allis-Chalmers single phase output driven by 110 V. D C. motor.

150—Additional units in stock including small size rotary convertors.

230 V. D.C. MOTORS

Qu.	H.P.	Make	Type	Speed
1	600	G.E.	600 v.	600/900
1	125	West.	SK	825
1	100	West.	SK-180	625
1	100	Rel.		475/635
1	75	West.	SK	475
3	75	Cr. Wh.	New	480/670
3	60	West.	SK-160	680
1	60	G.E.	C	480/1100
1	50	West.	CK-9	525
1	50	G.E.	RC-19	400/1200
1	45	Diehl	K-10	850
2	40	G.E.	DLC-25	1050
8	40	G.E.	CD1441	250/1500
1	40	Cr. Wh.	CCM	700
1	35	G.E.	RLC-204	440/800
2	35	West.	SK-160	400
1	30	G.E.	RC-32	1100
1	30	West.	S-6	1025
1	30	West.	SA	975
2	30	West.	SA	500/1500
1	25	El. Dyn.	10-S	1500
2	25	G.E.	RC-31	1150
1	25	West.	SK	1100
1	25	Rel.	92T	1150
1	25	West.	SK	900
1	25	G.E.	LC	900
1	25	Al. Ch.		850
4	25	G.E.	RF-12	500/1500
1	25	West.	SK	500/1500
1	25	G.E.	RF-11	500/1000
4	25	G.E.	RF-14	300/1200
1	25	G.E.	RF-14	300/900
1	25	West.	SA	325/975
2	20	West.	S	1300
1	20	R. & M.		1160
1	20	G.E.	CD-85	1150
1	20	G.E.	RC-11	1150
1	20	West.	SK-103	1200
1	20	West.	S-6	975
2	20	West.	SK-83	850
1	20	G.E.	RC	800
1	20	Al. Ch.	series	625
1	20	West.	HY-6	700
1	20	G.E.	RF-11	500/1500
10	20	G.E.	RF-12	400/1200
2	20	Star	SHB-30	29.2
2	16/25	Cr. Wh.	35-JA	400/1200
1	15	Roch.		3450
1	15	West.	SK-63	1750
4	15	Star	SQ-1520	1290
1	15	G.E.	RC	1200
1	15	West.	SK-80L	1100
1	15	G.E.	RC-29	1150
1	15	G.E.	RC-10	1150
1	15	G.E.	CDV-85	900
1	15	West.	SK	850
1	15	G.E.	CDE-83	850
2	15	G.E.	RC-30	850
2	15	G.E.	D	700
1	15	West.	SK	675/1350
1	15	G.E.	CQ	625
1	15	El. Dy.	5S	600/1200
1	15	G.E.	CQ	600/1500
1	15	West.	SK-100	600/2500
1	15	G.E.	LC	675/1150
1	15	Al. Ch.		400/1600
2	15	Rel.	155T	400/1600
1	15	G.E.	CD	400/1600
1	15	West.		400/1600
2	15	West.	SK-100L	500/1500
1	15	G.E.	RF-10	550/1000
1	15	G.E.	RF-11	400/1600
1	15	West.	SK	250/1100
1	15	Diehl		200/247
1	10	R. & M.		1300
1	10	West.	S	1325
1	10	G.E.	CD-75	1150
1	13	National	series	1100
1	10	G.E.	RC	1100
1	10	Triumph	TR-108	860
1	10	G.E.	RC-29	850
1	10	Dieh.	LS-14	750
1	10	West.	SK-7L	700
2	10	G.E.	CVC	700
1	10	Cr. Wh.	CSM	675
1	10	West.	SK	600/1200
2	10	G.E.	RLC	500/1500
1	10	G.E.	RF-10	400/1600
1	10	West.	SA	400/1200
1	10	G.E.	RF-10	400/1200
1	10	Rel.	131T	250/1000
1	7½	Sturt.		3600
1	7½	L.A.	284	1750
1	7½	El. Dy.	2S	1750
2	7½	Rel.	235	1750
1	7½	West.	SK-30	1750
1	7½	G.E.	RC	1700
1	7½	West.	SK	1800
2	7½	Cr. Wh.	CCM	1425
3	7½	West.	SK	1100
1	7½	G.E.	RC	1100
1	7½	G.E.	CO-1804	1200/3200
1	7½	West.	SA	975
2	7½	West.	SK-50	975
1	7½	Cr. Wh.	SM	910
1	7½	G.E.	RC	900
1	7½	Cr. Wh.	CCM	875
2	7½	G.E.	RC	850
1	7½	West.	SK-60	850
1	8½	West.	SK-30	825
1	7½	G.E.	RF-10	600/1500
1	7½	West.	SK-90	650/1300
1	7½	El. Dy.	3S	550/1650
2	7½	L. A.	BW-15	525/1150
1	7½	Roth	RS-107	450/900
1	7½	West.	SK-70	400/1600
1	7½	West.	SA	400/1600
1	7½	G.E.	RLC	400/1600
1	7½	Al. Ch.		350/1050
1	5	Star	SB-5	1750
1	5	Rel.	T-254	1750
2	5	West.	SK-20	1800
2	5	G.E.	RC	1700
1	5	G.E.	CDV	1750
1	5	West.	SK-23	1750
1	5	G.E.	CVC	1650
4	5	G.E.	CVC	1100
1	5	G.E.	CD-65	1150
1	5	Rel.	32T	1150
8	5	G.E.	RC-27A	1150
2	5	West.	SK-43	1150
1	5	G.E.	B-284	1150
3	5	Cr. Wh.	CCM	950
1	5	West.	SK-23	920
1	5	West.	SC-3	870/1750
1	5	Rel.	23T	850/1700
1	5	Al. Ch.	E-75	850
1	5	G.E.	RC	600
1	5	Cont.	D-49	600/1800
1	5	Star	SB-10	600/1200
1	5	El. Dyn.	3-S	550/1650
2	5	West.	SK-60	500/1500
1	5	Cr. Wh.	CM	400
2	3	G.E.	BD-235	3600

800—Smaller D.C. motors in stock including fractional.

110 V. D.C. MOTORS

Qu.	H.P.	Make	Type	Speed
1	60	Star	SQ-60L	1200
1	25	Star	15-L	2400
1	25	G.E.	CDM-95	1000
1	20	G.E.	CD-83	1750
1	16	Cr. Wh.	CMC-L	1750
1	15	West.		1150
1	15	El. Dy.	7½ S	615/1230
1	15	West.	S	550
4	10	Lincoln		3500
1	10	L. A.		3500
1	10	Al. Ch.	EBC-75	2175
1	10	G.E.	CD-73	1750
1	10	West.	SK-70L	850
1	10	Cont.		825
1	10	Rel.		400/1600
1	10	Diehl.		230
1	7½	G.E.	RC	1700
1	7½	I.G.E.		1300
1	7½	Cr. Wh.		1700
1	7½	Al. Ch.		1300
1	7½	West.	S	975
1	7½	G.E.	CVC	825
1	7½	El. Dy.	5 S	450/900
2	7½	Broomfield		1725
1	7½	West.	SK-294	84
1	7½	El. Dyn.	5S	600/1200
1	5	Kimble	BA-225	3500
1	5	Marathon		3500
1	5	West.	SK	1750
1	5	Diehl	DP-8	1750
1	5	West.	SK	1200
1	5	G.E.	CVC	1100
1	5	Burke	AB-5	1200
1	5/10	El. Dy.		800/1800
1	5	Burke	WAB-14	650
1	5	Cr. Wh.	CMC	600/1800
1	5	Imperial	D-38	800/750
1	5	Rel.		450/1800
1	5	West.	SK-70L	500
1	5	Watson	MW-15	350
1	5	El. Dy.	7½ S	260
1	5	Diehl		247
1	3	G.E.	RC	2100
1	3	F.M.	LA225	1200
1	3	Cont.	D-31	1150
1	3-3/4	Cr. Wh.		690
1	3	G.E.	CD-73	600/1600
1	3	Cr. Wh.	CMC	535/1050
1	3½	West.	SK	450/1800
1	3	El. Dy.	3S	450

600—Smaller size 110 V. D.C. motors including fractional horsepower motors also in stock.

SEND US YOUR INQUIRIES FOR A.C. EQUIPMENT

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D. C. MOTORS

	HP	Make	Type	Volts	Speed
2—	800/1000	Whse.		450	600/720
1—	800	G.E.	MPC	660	600
1—	700	G.E.	MCF	600	150/525
1—	650	G.E.	MPC	250	115/145
1—	600	G.E.	MPC	600	650/900
2—	350	G.E.	MPC	220	450
1—	335	Whse.	MQ	250	300/900
1—	325	Whse.		230	1050/1250
1—	300	G.E.	DMC	230	400/600
1—	300	G.E.	MPC	230	275/650
2—	300	Cr. Wh.	CCM-151-H	230	630/700
1—	250	G.E.	MPC	230	400/500
1—	250	Al. Ch.		230	525
1—	150	G.E.	MPC	230	250/450
1—	130	Cr. Wh.	CMC-65H	550	1200
2—	125	G.E.	CO	230	625
1—	100	G.E.	MPC	230	225/450
1—	75	Whse.	SK-180	125	650
1—	75	G.E.	C	230	500/1000
1—	75	G.E.	C	230	650/900
1—	60	El. Dy.	25-S	230	525/1050
2—	60	Whse.	Hoist	230	415
4—	50	Whse.	Hoist	230	400
2—	50	Cr. Wh.	65H	230	500/1000
5—	50-½ hr.	G.E.	MD-105B	230	550
1—	50	G.E.	RC-16	230	650
1—	50	Whse.	SK-160	230	565
1—	50	El. Dy.	50S	500	194/775
1—	50	Cr. Wh.	CMC-80H	230	380/750
1—	50	Cr. Wh.	CMC-81-H	230	300/900
1—	40	Whse.	SK-120	230	1700

TURBO GENERATOR SETS

1—500 KW Whse. 625 KVA 440 V., 3 ph. 60 cy. 3600 RPM with Parsons' 145/175 lb. condensing turbine complete with jet condenser, and accessories.
1—300 KW Whse. D.C. 120/240 V., 1200 RPM. Driven through reduction gear by turbine 5965 RPM., 440 lb. 740° T.T. Condensing.
1—125 KVA GE 2300 V. 3 ph. 60 cy. 3000 RPM. 150/200 lbs. Non-condensing.
1—100 KVA. GE 2400 V. 3 ph. 60 cy. 3600 RPM. 150/200 lbs. Non-condensing.
1—75 KW Ridgway 250 V. D.C. with Terry 180 lb. pressure with 12 lbs. back pressure, 2000 RPM.

SPECIAL

1—2500 Kva. GE. Auto-extraction, 3600 RPM, 150/175 lbs., Surface Condenser & Accessories; 3 ph., 60 cy., 480 v., direct connected exciter. Immediate Shipment.

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1500 KW GE 275 V. d.c. to 2150 HP., 2200/4400 V. Syn Motor with exciter.
1—1000 KW Al. Ch. 450 V. d.c. to 1250 KVA 2300 V.
1—500 KW GE-600 V. d.c. to 700 HP-2300 V.
1—400 KW 3 unit with (2) 200 KW GE 125 V. D.C. gens. and 600 HP. 2300 V. Syn. Motor.
1—300 KW GE 550 V. d.c. to 435 HP, 2300/4000 V. with exciter.
1—250 KW GE-275 V. d.c. to 350 KVA, 2300 V. with exciter.
1—250 KW Al. Ch. 250 V. d.c. to 340 KVA 2200 V.
1—200 KW GE 250 V. d.c. to 300 HP-440 V.
1—150 KW Whse. 250 V. d.c. to 270 KVA 440 V. with exciter.
1—150 KW Whse. 600 V. d.c. to 225 HP. 2300 V.
1—150 KW Whse. 3 unit (2) 75 KW 125 V. gens. d.c. to 300 HP. 2300 V. Ind.
2—120 KW Whse. SK-151 B 250/275 V. d.c. to 200 HP. 2300 V. Ind. motor.
1—85 KW GE 250 V. DC to 150 HP. 440 V. Sq. Cg. Motor.
1—75 KW GE 125 V. Gen. to 120 HP. IK 4000/2300.
2—48 KW 3 unit with 2—24 KW GE 60 V. Gens. d.c. to 75 HP. 440 V. Ind. Motor.
1—26.4 KW W.E. 38 V. Gen. d.c. to 41.5 HP. 220 V.
1—19.8 KW W.E. 33 V. Gen. d.c. to 32 HP. 220 V.

SPECIAL

1—500 KW G.E. 250 V., M.G. Set, 700 HP. 2300/4000 V., 3 ph., 25 cycle, with controls.

ROTARY CONVERTERS

60 cycle

KW	Make	Speed	D.C. Volt	Trans Volts
1— 1500	Whse.	720	600	2300
1— 1500	Whse.	600	600	1500
1— 1250	G.E.	720	250	2300
1— 1000	Whse.	900	600	11000
1— 750	Whse.	900	600	13200
1— 750	Whse.	720	250	6600/2300
1— 500	Whse.	1200	600	13200/2300

All units can be furnished with AC and DC Controls.

SPECIAL

1—2000 amp. 3 PST 15000 V. 250 V. Sal Operated Condit type F-120-15D OCB 1,000,000 Kva interrupting Capacity.

A. C. MOTORS

3 ph. 60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
2—	2100	G.E.	ATI	2300/4600	514

Slip Ring

1—	2500	G.E.	MT	6600	253
1—	1000	G.E.	MT	6600/2300	600
1—	1000	Whse.	CW	2300	705
1—	350	G.E.	MT-442y	4000/2300	257
1—	300	G.E.	IP	2300	390
1—	300	Whse.	CW	440	1800
1—	250	Al. Ch.	ANY	440	705
1—	200	G.E.	IM-17A	440	495
2—	200	Whse.	CW-1000	440	580
1—	250	G.E.	MT	4000	257
1—	225	G.E.	IM	550	720
1—	100	G.E.	IM	220	430
1—	90	Wagner	BR-26V4	220/440	650
1—	75	F.M.	BY	2200	1750
3—	50	Whse.	CI	220	870

Squirrel Cage

1—	250	G.E.	IK	440	600
2—	150/70	G.E.	IK	440	1170/870
1—	100	G.E.	IK-vert.	2300	450
2—	100	G.E.	IK	440	865

D.C. GENERATORS

	KW	Make	Type	Volts	Speed
1—	1200	Al. Ch.	MHC	525	750
1—	500	G.E.	MPC	600	720
1—	200	Al. Ch.		250	550
2—	200	G.E.	CY-214	250/275	900
1—	150	G.E.	MPC	125	200
1—	150	Whse.	SK-151B	275	1200
2—	100	Whse.		240	350

SPECIAL

2—2000 Amp. 3 PST—25000 V. Sal. operated Whse. type CO-11 OCB—400000 KVA Interrupting Capacity—Immediate Shipment.

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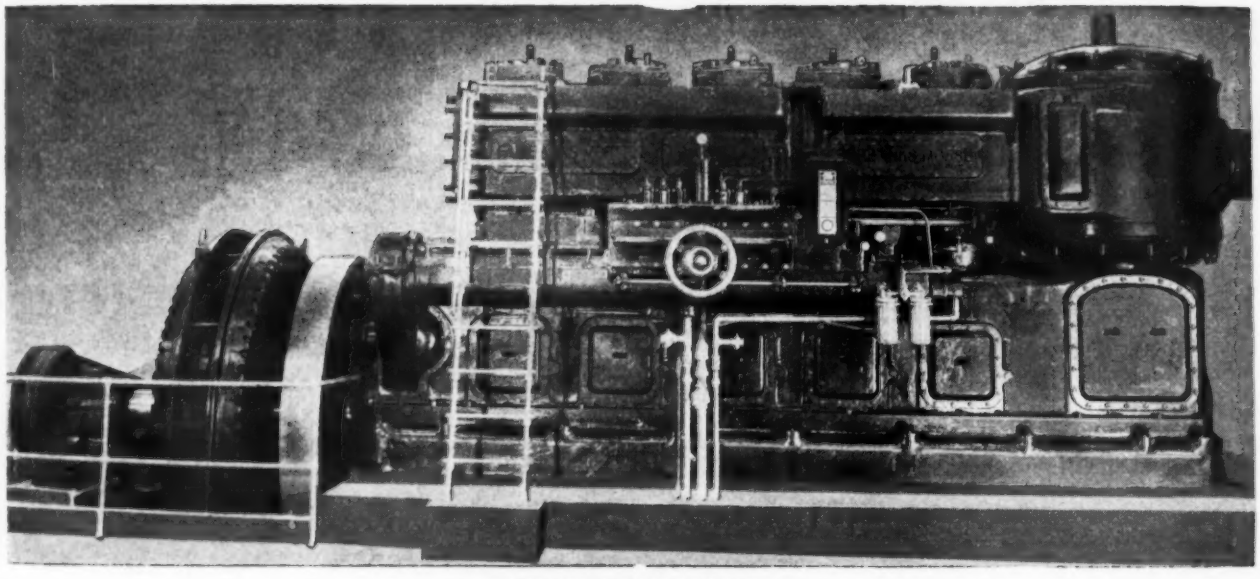
POWER PLANT MACHINERY



ACTUAL PHOTOGRAPH

646 KVA FAIRBANKS-MORSE DIESEL ENGINE GENERATOR UNIT

517 KW 80% P.F. 646 KVA Fairbanks-Morse alternating current generator, 3 phase 60 cycle 2400 volts, 257 RPM, direct connected to 750 HP Fairbanks-Morse diesel engine, model 33D16, 5 cylinders, 16" bore, 20" stroke, 2 cycle, 257 RPM. Generator complete with exciter and switchboard equipment. Engine complete with motor driven air compressor with tanks, motor driven circulating water and oil pumps, oil purifier, oil cooler, air filter, pyrometer, gauges and Maxim silencer. This unit is in excellent condition and can be shown in operation.

UNIFLOW ENGINE GENERATOR UNITS

3 phase 60 cycle

750 KVA Nordberg 4000 volts 175# pressure, 15# exhaust.
750 KVA (2) Skinner 2300 volts 175# pressure, 15# exhaust.
560 KVA Skinner 480 volts 150# pressure, 20# exhaust.
375 KVA Skinner 2300 volts 150# pressure, 5# exhaust.
350 KVA Ames 2300 volts 150# pressure, 10# exhaust.
210 KVA Skinner 240 volts 150# pressure, 5# exhaust.
150 KVA Ames 240 volts 150# pressure, 3# exhaust.

SYNCHRONOUS CONVERTERS

3 phase 60 cycle

2000 KW Allis Chalmers 600 volts D.C., 4150 Volts A.C.
1500 KW Westinghouse 250 volts D.C., 2300 volts A.C.
1000 KW (3) General Electric 600 volts D.C., 33000 volts A.C.
750 KW General Electric 600 volts D.C., 22000 volts A.C.
100 KW Westinghouse 250 volts D.C., 440 volts A.C.

STEAM TURBINE GENERATOR UNITS

Condensing

3 phase 60 cycle

12500 KVA G.E. 1100 volts 275#
3750 KVA Wstgh. 4160 V. 200#
3125 KVA Wstgh. 2300 V. 200#
2500 KVA G.E. 2300 V. 200#
2500 KVA G.E. 600 V. 150#
1875 KVA G.E. 2300 V. 175#
1563 KVA G.E. 600 V. 175#
1250 KVA Wstgh. 2300 V. 150#
937 KVA G.E. 2300 V. 150#
750 KVA G.E. 2300 V. 150#
625 KVA G.E. 2300 V. 170#

STEAM TURBINE GENERATOR UNITS

Automatic Extraction

3 phase 60 cycle

3750 KVA (2) G.E. 2300 volts 200# pressure, 20# extraction.
3750 KVA Wstgh. 2300 volts 150# pressure, 10# extraction.
1560 KVA Wstgh. 480 volts 200# pressure, 15# extraction.
1250 KVA Allis 480 volts 300# pressure, 35# extraction.
1250 KVA Terry 480 volts 250# pressure, 25# extraction.
780 KVA Wstgh. 2300 volts 185# pressure, 15# extraction.
625 KVA Wstgh. 480 volts 250# pressure, 25# extraction.

DIESEL ENGINE GENERATOR UNITS

3 phase 60 cycle

646 KVA Fairbanks Morse 2400 volts 257 RPM.
625 KVA Fulton 440 volts 164 RPM.
500 KVA (2) McIntosh-Seymour 2300 volts 164 RPM.
300 KVA (2) Fairbanks Morse 2400 volts 257 RPM.
250 KVA Fairbanks Morse 2300 volts 257 RPM.
250 KVA Buckeye 240 volts 514 RPM.
180 KVA Fairbanks Morse 240 volts 257 RPM.

STEAM TURBINE GENERATOR UNITS

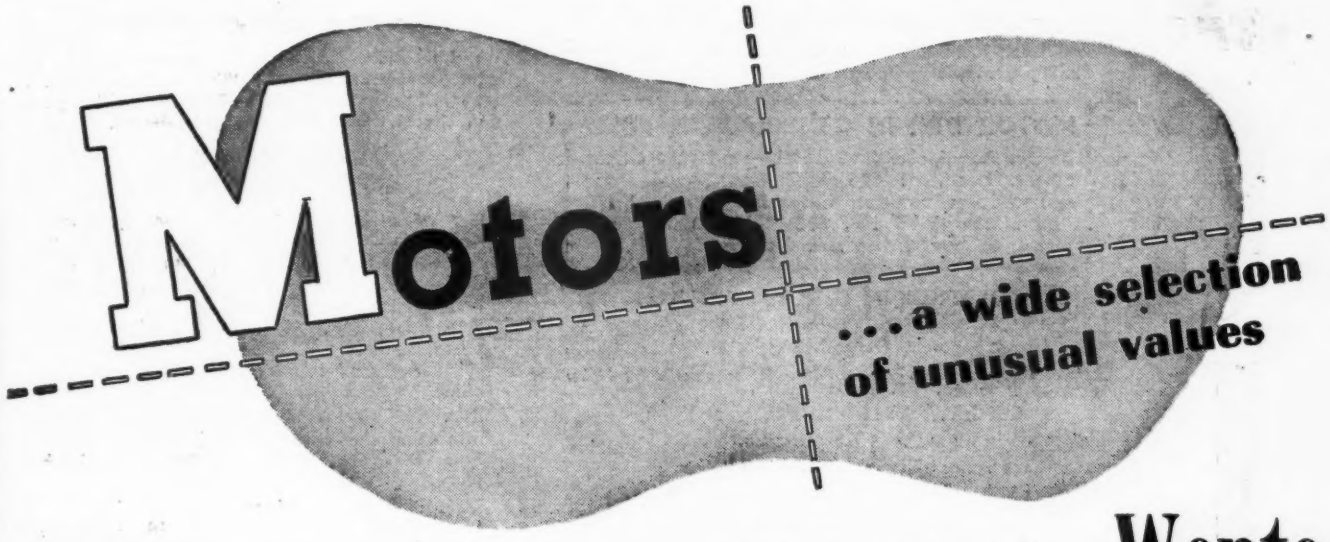
Noncondensing

3 phase 60 cycle

1563 KVA Kerr 2300 volt 200# pressure, 15# exhaust.
937 KVA Moore 2300 volt 175# pressure, 20# exhaust.
875 KVA Moore 2300 volts 300# pressure, 100# exhaust.
625 KVA Terry 2300 volts 200# pressure, 85# exhaust.
375 KVA General Electric 240 volts 150# pressure, 10# exhaust.
250 KVA Westinghouse 480 volts 300# pressure, 30# exhaust.
187 KVA General Electric 480 volts 250# pressure, 15# exhaust.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 9514 CLEVELAND 14, OHIO



Listed below a few of the motors available in a hurry from Wente

SQUIRREL CAGE

3 Phase, 60 Cycle, 220/440 Volt.

Qu.	HP	Make	Type	Speed
1	300	G.E. 440v.	ATI 1800 RPM Syn.	
1	250	G.E. 440v.	KF 3600 RPM Vert.	
5	200	G.E. 2300v.	FT527	1800
1	150	Al. Ch.		1750
2	125	L. A. 2300v.	Ball Bearing	3600
1	100	R'way 440v.		1200
1	100	West. 2200v.	CCL	1720
1	100	G.E.	I	340
1	100	G.E.	I	290
1	100	West. 440v.	CS	870 RPM
1	100	G.E. 440v.	PCS	375 RPM
1	50	G.E.	I	720
2	50	West.	MS 25 cy.	720
1	50	Wag.	BM	495
1	50	Al. Ch.		490
1	40	West. 2200v.	CS	870 RPM
2	35	Al. Ch.	2 hp.	865
2	35	Al. Ch.		865
1	35	Ft. Wayne	2 ph.	900
1	35	G.E.	25 cy.	730
1	30	F.M. 2200v.	HD12B	3600
1	30	Al. Ch.		1200
1	20	Louis A.	KH	1170
1	30	West.	CCL	900
2	30	Al. Ch.	An 2 ph.	860
1	30	Century	AS 25 cy.	720
1	25	Howell		1200
1	25	Lincoln		900
1	25	Al. Ch.		860
1	25	Rel. (elevator)	T.E.	750
1	25	Al. Ch.		720
1	25	G.E.	M10	720
1	20	Al. Ch.		1160
1	20	Al. Ch.		860
1	20	Al. Ch.		1700
1	20	Century		1740
1	20	F. M.	KRV	1200
1	20	West.		1200
1	20	Ideal	A	1150
1	20	Clev.	M-147	900
1	20	Al. Ch.		860
1	20	West.	CS-644	870
1	20	West.	MS	900
1	20	West.	CCL	580
1	20	Wagner	CM	445
2	20	(New) West	220/440v. CS404, 1200 RPM	
1	20	(New) G.E.	220/440v. KF404, 1200 RPM	
	18	West.	MS-4 (Elev.)	720
1	15	West.	CCL	1700
1	15	Cr. Wh.	115Q	1720
2	15	West.	CS-573 25 cy.	725
2	15	West.	MS 25 cy.	725
1	15	West.	CS567C 25 cy.	715
1	15	West.	MS 25 cy.	600
1	10	West.	CS 25 cy.	725
1	10	West.	MS 25 cy.	720
2	10	West.	CS473C 25 cy.	615
1	7½	Wagner	MCP-365 TEFC	1140

SLIP RING

3 Phase, 60 Cycle, & Syn.

Qu.	HP	Make	Type	Speed
1	443	El. Mach.		900 Syn
1	200	F.M.	BV	600
1	200	Westg. 2200v.		600 Syn
2	75	F.M. 2200v.	BV-H16B	1800
1	50	Triumph	C12	1150
1	50	Ideal 2200v.	AV	575
1	50	G.E.	IM 25 cy.	700
1	50	Al. Ch.		690
1	50	West. 220v.	CW752 690 RPM	
2	40	G.E.	MT336	1200
1	40	Al. Ch.		1160
1	40	W'g 2200v.	CW	870
1	40	Westg.	CW-658-A	870
2	40	Al. Ch.		870
1	40	Westg.	C1753A 25 cy. cr.	730
10	35/15	G.E.	OMT336	1150/550
1	35	Al. Ch.	25 cy.	720
2	35	G.E.	IM	570
1	30	F.M.	AD Alt.	1200
1	22	G.E.	ITC5011 (hoist)	680
1	25	Westg.	MW 322A	680
1	25	G.E.	MT342	600
1	25	G.E.	MT356	400
1	20	Triumph	C10	1200
2	15	G.E.	MT302	1200
1	15	G.E.	MT332	720
1	15	G.E.	MT556	280
3	10	Westg.	CW464A	1200
1	10	Westg.	HF	1140
1	7½	G.E.	MT182	1750
6	2	G.E.	MT926 slip ring	1800

DC—230 Volt

Qu.	HP	Make	Type	Speed
1	75	Diehl	K11	700
1	100	G.E.	CD123	1200
1	60	Westg. 115v.	SK140L Vert.	1140
1	60	G.E.	EFI	1200
1	40	Rel. 440v.	13LT Vert.	1750
1	40	Rel. 440v.	230T Vert	1130
1	25/40	C.W. 440v.	CMC-EH Vert.	1150/1750
2	40	Westg.	SK 123	1150
3	40	G.E.	RC32	1100
8	40	Westg.	SK 140	775
1	35	Al. Ch.		1200
1	35	G.E.	DLC 203	700
1	35	Westg.	SK 163 Vert.	300/1200
1	30	El. Dy.	15S	625
1	30	Rel. 440v.	131 T. Vert.	1150
4	30	Reliance	92 TF	1750
1	27½	G.E.	CVC 116	1750
7	25	Westg.	SK 120	825
2	25	Westg.	SK 103	1150
1	25	Westg.	SK 90	1400
4	25	Westg.	SK 100 I	1150
1	30	G.E.	RC 51B	1150
1	25	Westg.	SK 123	550/1100
1	25	Al. Ch.	E 120	500/1500
1	25	J. & L.		625
2	20	Reliance	131T	1000
2	20	Diehl	K914A	500/1500
1	20	G.E.	RF12	250/1000
1	20	Lincoln	FKW B.B.	1800
6	20	Cr. Wh.	CMC T.E.B.B.	1750
1	20	Cr. Wh.	CMC T.E.B.B.	1150
1	20	Westg.	SK93	1150
14	20	Reliance	92T	1150
1	20	Westg.	SK 120 T.E.	1100
3	20	Westg.	SK 100L	900
1	20	Watson	K	850
3	20	Reliance	131T	850
1	20	G.E.	RC30	750
1	20	Westg.	SK110L-115V	750

DC—230 Volt

Qu.	HP	Make	Type	Speed
4	20	Westg.	SK110L	750
1	20	Cr. Wh.	CW-CMC	600
1	20	Westg.	SK-120	500
3	20	Al. Ch.	K	500/1000
2	15	Westg.	SK63	1750
1	15	Westg.	SK113 encl.	1750
1	15	Westg.	SK93	1150
4	15	Westg.	SK83	1150
4	15	Cr. Wh.	CW-CCM T.E.	1150
1	15	Westg.	SK70L	1250
1	15	G.E.	CD83	1150
1	15	G.E.	RC10	1150
1	15	G.E.	RC29	1150
4	15	Westg.	SK93	850
4	15	Reliance	92TF	850
4	15	R. & M.		1000
1	15	G.E.	CVC-115	925
6	15	Westg.	SK90 Vert.	825
1	15	G.E.	RC29	750
6	15	Westg.	SK110L	675
1	15	Al. Ch.		1075
8	15	Reliance	131T	550
3	15	Reliance	92T	850/1750
3	15	Reliance	92T	850/1700
1	15	Reliance	66T	800/1600
1	15	Westg.	SK	500/1500
2	15	Westg.	SK110L	400/1600
1	15	Triumph	32F	300/600
1	15	Triumph		225/900
1	12½	Westg.	SK	750/1500
7	10	Westg.	SK70	850
2	10	G.E.	RC29	850
2	10	Reliance	66TF	850
20	10	Westg. SK60L-SK60-Reliance 46TF		1150
7	10	Cr. Wh.	CM CHB T.E.B.B.	1750
1	10	G.E.	RF11	600/2400
3	10	G.E.	RF10	600/1800
6	10	Westg.	SK80L	500/1500

DC—230 Volt

Qu.	H.P.	Make	Type	R.P.M.
23	10	Al. Ch.		500/1000
1	10	G.F.	RF10	400/1200
2	10	Kimble	BA324 new B.B.	1750
1	10	Westg.	SK91	250/1000
15	7½	Westg.	SK33	1750
16	7½	Westg.	SK43	1150
20	7½	Westg.	SK60	850
20	5	Westg. & G.E.		1750
20	5	Westg. Rel.		1150
35	5	Westg.	SK43	580
50	3½	Westg.	SK33	850
50	3	Westg.	CD925	1725
70	3	Westg.	SK20	1550
60	2	Westg.	SK & CD	1150
50	2	Westg.	SK20	850
40	1½	Westg.	CD	1150
30	1½	Westg.	CD925	550/2200

44 New vertical TEFC BB 3 phase, 220/440 volt, 60 cycle, as follows:
1—G. E. 2 HP—1200 RPM—ty. K, frame 225
1—Fairbanks Morse, 3 HP, 1200 RPM, Type QZCU, Frame 254
2—Delco 3 HP, 1200 RPM, Type C Frame 254
3—G. E. 3 HP—1200 RPM—ty. K, frame 254
1—General Electric, 5 HP, 1800 RPM, Type K Frame 254
8—General Electric, 7½ HP, 1200 RPM, Type K Frame 324
7—Delco, 7½ HP, 1200 RPM, Type C Frame 324
1—Howell, 7½ HP, 1200 RPM, Type K Frame 324
2—Howell, 7½ HP, 1800 RPM, Type KV Frame 284
2—Delco 10 HP, 1200 RPM, Type C Frame 326
6—Delco 15 HP, 1200 RPM, Type CL Frame 365
6—G. E. 15 HP—1200 RPM—ty. K, frame 365
2—Howell, 15 HP, 1200 RPM, Type KV, Frame 365
2—Delco, 20 HP, 1200 RPM, Type CL, Frame 404
2—Howell, 20 HP, 1200 RPM, Type K Frame 404

6—New General Electric Synchronous Motors Type T.S. 200 H.P. 300 RPM, 2200 volt .8 p.f. Complete with control & separate motor generator exciter set.
1—150 KW Westinghouse, synchronous M-G set, 275 Volt DC, 4400 Volt AC, 3 ph., 60 cycle, 900 RPM, AC control and DC panel.
1—150 KW General Electric, M-G set, 250/275 Volt, DC—440 Volt AC—3 phase, 60 cycle, 900 RPM.
2—Ridgeway 100 KW, Synchronous M-G sets, 250 volt DC, 2300 volt AC, 3 ph., 60 cycle, 1200 RPM, AC controls and DC panel.
1—Burke 200 KW, synchronous M-G sets, 260 volts DC, 440 volts AC, 3 ph., 60 cycle, 900 RPM, with AC and DC controls.

1—New G. E. 250 HP, ty. KF, fr. K 549A., 440 V., 3 Ph., 60 Cy., 3600 RPM vert. direct connected to Bingham, type 2, 22 stage double case, 3600 RPM, 3820 head, 175 GPM pump.

The Wente Electric Co.

Hamilton, Ohio

Rebuilt Motors & Generators

Since 1906

THE GLOW ELECTRIC CO.

SPECIAL—NEW PLATING GENERATORS

200 Amp., 10 to 15 volt, 1725 RPM, direct current, Master Plating Generators with overhung exciter.

MOTOR DRIVEN CENTRIFUGAL PUMP

Dayton Dowd, size 6x18 CSLF, rated 7250 G.P.M. 30 ft. head, at 685 RPM Centrifugal Pump mounted on common base and driven by:— Continental 75 HP, 695 RPM, 2200 volt, 3 phase, 60 cycle, drip proof motor.

COPPER OXIDE PLATING RECTIFIERS

500 Amp., 6 volts, Direct Current, for 440 volt, 3 phase, 60 cycle power, General Electric, Model 6RC120F2.

Note: Designed to be operated in series or parallel for higher voltage or current.

SIX NEW DIRECT CURRENT MOTORS

25 HP, 1750 RPM, 230 volt, compound wound, Marble-Card motors, Marine type, drip proof.

A. C. GENERATORS

(3 phase unless otherwise noted)

KW	P.F.	RPM	Volts	Description
3	1	1800	120/206	Hobart, 4 Wire, Ball Bearing
3.2	.8	1170	440	Westinghouse
4	1	1170	440	Westinghouse, Single Phase
15	1	1800	127/220	General Electric, Single Bearing
20	1	1800	110	Ft. Wayne, Single Phase
40	.8	1200	220	Burke, Single Bearing
50	.8	1200	120/208	Electric Machinery, Single Bearing, 4 Wire
60	.8	1200	240	General Electric
87½	.8	900	110/220	Starr, Single Phase
100	.8	900	200	Crocker-Wheeler,
100	1	900	2300	General Electric
120	.8	257	2300	General Electric, Single Bearing
125	1	900	220	Westinghouse, Single Bearing
100	1	600	480	Burke
100	1	900	2400	Westinghouse
100	.8	1800	220	Westinghouse
200	.8	600	480	Crocker-Wheeler

NEW A. C. GENERATORS

5KVA, 1800 RPM, 120/240 volt, 1 phase, 60 cycle, Master Generators with overhung exciters—generators single bearing for direct connection to driving motor or engine. Complete with stwitchboard.

GAS ENGINE— AC GENERATOR SETS

2½ KW Leland, type A, frame 50, 1800 RPM 120 volt, single phase, 60 cycle, AC Generator, with Briggs & Stratton, Model ZZ, 6 HP, 1800 RPM Gasoline Engine, U. S. Army PE75AA, complete with gas tank and tool box.

5 KVA Onan, .8 P.F., 1800 RPM, 110/220 volt, single phase, 60 cycle, AC Generator with Onan, twin, 4 cylinder Gasoline Engine complete with starting panel.

7½ KVA, 120 volt, 3 phase, 60 cycle, AC Generator with 4 cylinder Wisconsin Engine, U. S. Army PE99, type VE4-1, size 3 x 3¼, complete with switchboard panel.

10 KVA, 110/220 volt, single phase, 3 wire, 60 cycle, Westinghouse, AC Generator with water cooled Jeep Engine Drive, U. S. Army PE95, 4 cylinder. Complete with switchboard panel.

25 KVA Westinghouse, 20 KW, .8 P.F., 900 RPM, 120 volt, 1 phase, 60 cycle, AC Generator, with LeRoy Gas Engine complete with control panel.

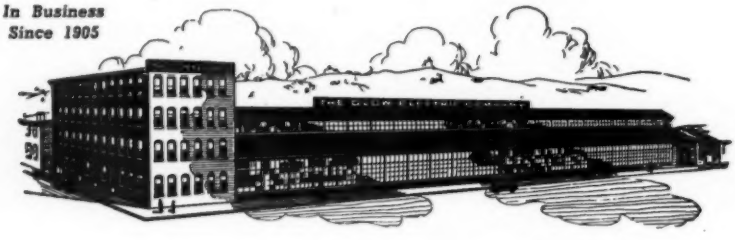
31.25 KVA, 25 KW Westinghouse, .8 P.F. 1200 RPM, 208/120 volts, 3 phase, 60 cycle, AC Generator with LeRoy Gas Engine complete with control panel.

Note: In addition to the above Engine Generator Sets, our stock includes practically all sizes up to 35 KVA both AC and DC, some with Diesel Engine Drive.

WORM GEAR RIGHT ANGLE GEAR HEAD MOTORS

General Electric, ¾ HP, 1750 RPM, 220/440 volt, 3 phase, 60 cycle, ratio 17½ to 1, output speed 99 RPM.
General Electric, ¾ HP, 1750 RPM, 220/440 volt, 3 phase, 60 cycle, ratio 36 to 1, output speed 48 RPM.

In Business Since 1905



Late Type TURBO-GENERATOR SET

Westinghouse, 300 KW, 1200 RPM, 120/240 volt, compound wound, D.C. Generator with interpoles, directly connected to:

Joshua Handy Steam Turbine, 5965 RPM, for steam conditions of 440 lbs. per sq. inch gauge inlet pressure 28½" vacuum, 740 deg. F. total temperature. Including speed reducer, rheostat and balancer coil.

WELDER SETS

Amps.	Voltage	Manufacturers	Driven By
75	25	Hobart	3 HP, 220/440 V., 3 ø ph. 60 cy.
100	25	Lincoln	5 HP, 220 volt, 3 ph. 60 cy.
25	25	Ideal	7½ HP, 220 volt, 3 ph. 60 cy.
150	70	Arc Weld Mach. Co.	No Motor
150	45/35	Wilson Plastic Arc	7½ HP, 230 volt, Direct Current
150	25	Imperial	No Motor
150	6 arc capacity	Arc Weld Mach. Co.	30 HP, 220 volt, 3 ph. 60 cy.
175	55/25	Westinghouse	7½ HP, 220/440 V., 3 ph. 60 cy.
200	60/20	General Electric	1800 RPM—No Motor
200	60	Todd	7½ HP, 220 volt, 3 ph. 60 cy.
200	40	Lincoln	10 HP, 220 volt, 3 ph. 60 cy.
200	25	Lincoln	10 HP, 220 volt, 3 ph. 60 cy.
300	25	Westinghouse	15 HP, 230 volt, Direct Current Motor
300	25	Westinghouse	15 HP, 230 volt, Direct Current Motor
300	40	Wilson, single bearing for direct connection at 1800 RPM	
300	40	Lincoln	20 HP, 440 volt, 3 ph. 60 cy.
300	40	Lincoln, single bearing for direct connection at 1400 RPM	
300	40	Ideal	20 HP, 220 volt, 3 ph. 60 cy.
400	20	Wilson	No Motor
500	60	Westinghouse	45 HP, 220 volt, 3 ph. 60 cy.
1000	30	Westinghouse	50 HP, 220 volt, 3 ph. 60 cy.
1000	60	Westinghouse	92 HP, 220/440 V., 3 ph. 60 cy.
400	40	Lincoln	25 HP, 220 volt, 3 ph. 60 cy.

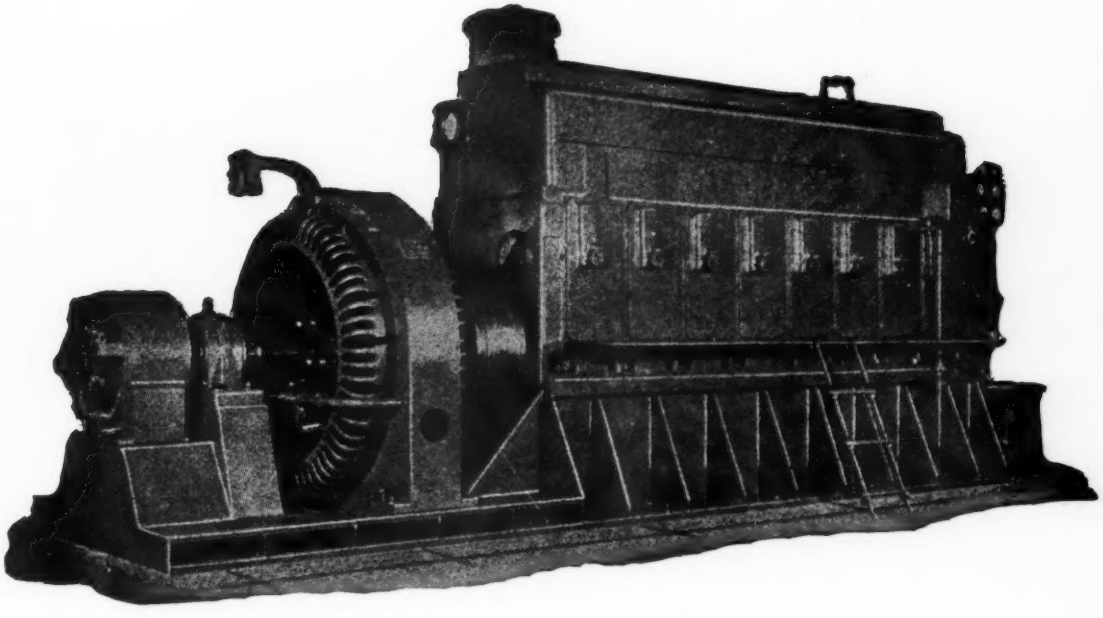
The items listed above are only a partial list of the large stock of electrical equipment which is available to meet your requiremnts.

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC HOISTS
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

933-943 HARRIET ST.
PHONE MA. 3024
CINCINNATI 3, OHIO

38 NEW BUCKEYE DIESEL ENGINES

DELIVERY TO-DAY



225-300-450 H. P.

4—5—8 Cylinder Model 80

10½ x 12—600 RPM.

ALSO COMPLETE GENERATOR PLANTS

150—200—300 KW

Some for Prompt Delivery

SEVERAL OTHER UNITS 100 TO 2000 HP

DIESEL MOTORS CORPORATION

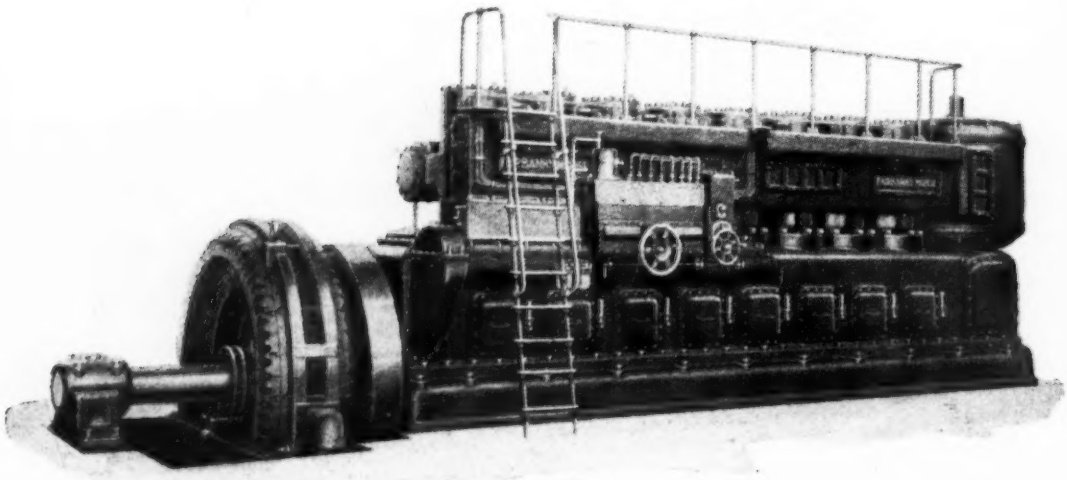
PORT WASHINGTON, LONG ISLAND, N. Y.

ROSLYN 1600.

2000 H. P. FAIRBANKS MORSE

1875 K.V.A. DIESEL POWER PLANT

Latest Model 33—240-480-2300 Volt



OTHER IMPORTANT OFFERINGS—PROMPT DELIVERY

HP	Model	KVA	RPM	New
2—2000	Fairbanks-Morse 33	1875	300	99%
6—1600	General Motors 16-278A	1200	720	90%
3— 900	Alco 540	750	600	95%
2— 600	Fairbanks 33F	500	400	99%
1— 450	Fairbanks 33E	375	360	95%
1— 375	McIntosh Seymour	375	360	85%
1— 350	General Motors 8-268A	250	1200	85%
1— 150	General Motors 3-268A	125	1200	85%
1— 360	Fairbanks YVA	300	257	80%
2— 240	Fairbanks YVA	200	257	75%
3— 175	Murphy	141	1200	99%

ALSO PORTABLE GASOLINE UNITS

3 — 5 — 7½ — 10 — 15 — 30 — 50 KW

Running Inspection on original foundations

DIESEL MOTORS CORPORATION

PORT WASHINGTON, LONG ISLAND, N. Y.

ROSLYN 1600.

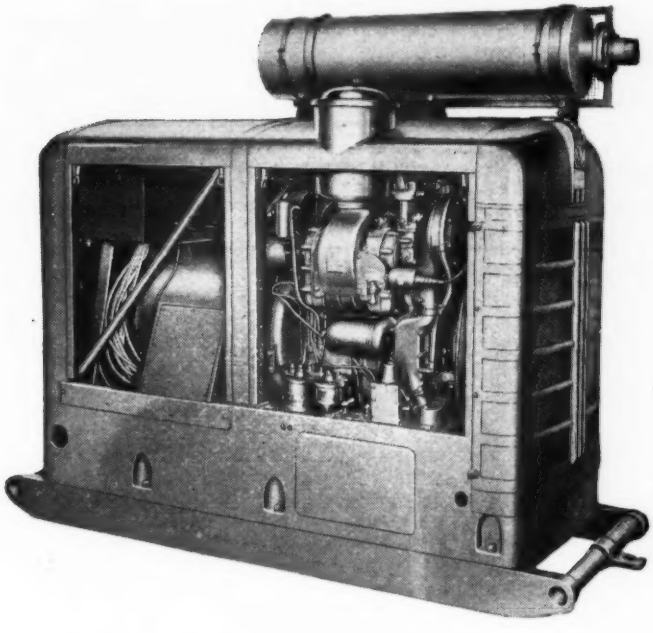
327 GENERAL MOTORS MODEL 371

30 KW PORTABLE DIESEL GENERATOR SETS

3 phase 60 cycle 127/220 Volt

3 phase 50 Cycle 230/400 Volt

BRAND NEW



IMMEDIATE DELIVERY

Also

3-5-7½-10-15-30-50-60 KW Diesel and Gasoline Generator Sets

Also

Large stationary Diesel Engines and generator sets

DIESEL MOTORS CORPORATION

PORT WASHINGTON, LONG ISLAND, N. Y.

ROSLYN 1600.

1500 KW G. E. EXTRACTION-CONDENSING UNIT

150/250# initial—20# ga. auto. extraction—60/3/480 v. rewound
Surface Condenser—all auxiliaries—complete—good condition

3000 KW WESTINGHOUSE CONDENSING TURBO GENERATOR

200# 100°—60/3/2400—4160Y—Surface Condenser
Turbine—46 CW Frame—rebuilt—all in excellent shape

3φ 1500 KVA—12000 primary—rebuilt
3φ 4000 KVA—22000 primary—new
3φ 4000 KVA—22000 primary—new—1944
3φ 4000 KVA—13200 primary—new—1944
1φ 3600 KVA Bank—13200 primary—new—1944
1φ 150 KVA (2 units) 1200 primary w/Scott taps
3φ 200 KVA 230 primary—120/60 secondary
New—with voltage regulator

VERY GOOD EXTRACTION-CONDENSING MACHINE—CAN SHIP QUICK

1000 KW—0.8 p.f.—250# 550° 25# g. extraction—60/3/480 11 stage turbine—double bucketed in high—13.5#/KWH condensing W.R.—direct connected exciter—surface condenser switchgear—Built 1929—mate duplicate installation—regular maintenance and renewals.

FOR YOUR FUTURE PLANNING—AVAILABLE SUMMER 1947

10,000 KW 0.8 p.f.—200# 500° 35# g. extraction—60/3/2400 semi-double flow—turbo built about 1915-16 but completely overhauled and reconditioned 1943—excellent physical condition—surface condenser, all auxiliaries, switchboard, etc.—extraction uncontrolled.

STRAIGHT—CONDENSING TURBO SET 450# 650°

1500 KW—0.8 p.f.—60/3/240—built 1928—surface condenser all auxiliaries—reported excellent physical condition.

TURBO ALTERNATORS

Condensing

300 KW 240 V 150# 100° Surf Cond (new 1929) factory rebuilt
1000 KW (3 units) 2400 V 150# 100° Jet Cond (new about 1922)
1250 KW 2400 V 200# 100° Surf Cond (new 1924)
1500 KW 480 V 200# 100° Jet Cond (new 1920)
2000 KW 600 V 200# 100° Jet Cond (new 1920)

Non-Condensing

100 KW 240 V 175# 100° ISP 0 to 5# g. BP (new 1921)
500 KW 480 V 175# 100° ISP 5 to 20# g. BP (new 1920)
1500 KW 2400 V 175# 100° ISP 10# g. BP (new 1926) Rebuilt
1500 KW 240 V 400# 650° ISP 90# g. BP (new 1928)

DC TURBO UNITS

750 KW 250 V 16#/165# (M.P.) Jet Condenser
500 KW 250 V 16#/165# (M.P.) Condenser
150 KW (2 units) 250 V 225# 25# g. BP modern design

ENGINE GENERATORS

60 cycle 3 phase

400 KW 480 V Allis Corliss 175# 150° ISP 25# (new 1924) excellent unit
600 KW 2400 V Chuse Uniflow 200# C or NC (new 1922)

DC ENGINE SETS

200 KW (3 units) 250 V DC Hamilton Corliss left hand
250 KW 1250 V DC Erie Ball built 1916 (2 units)
600 KW 250 V DC 3-wire Skinner Vertical Uniflow 150# ISP 3" g. BP (new 1931) good condition

BOILERS

Water Tube

365 HP (2 units) 200# 100° Stokers Edgemoor str tube (new 1923)
600 HP (2 units) 160# pulverized firing—sect'l hdr. Pennsylvania
400 HP 400# 650" sect'l hdr (new 1928)

Fire Tube

90 HP 118# stoker equipped ASME Mich. Code HRT
250 HP 125# grates and stack non-code Scotch Marine
125 HP (ten units) 300# Oil Country Boilers ASME Code
400 HP—2 units—Scotch Marine ASME Code—150#
And a few modern 450-500-700 psi Generating Units

DIESEL ENGINE GENERATORS

60 cycle 3 phase

400 KW/600 HP 480 V Clark 2 cycle vertical 400 RPM
375 KW/560 HP 2400 V Fairbanks Model 33, 257 RPM
540 KW/800 HP 480 V 4 cycle 6 cylinder 360 RPM new units
465 KW/700 HP 2400 V Fairbanks Model 33, 257 RPM
440 KW/650 HP—2400 v. ENTERPRISE—rebuilt—guaranteed
1500 KW—Plant complete—Fairbanks-Morse—fair condition

POWER UNITS

180 HP Fairbanks Model 32E12 (new unit)
225 HP Buckeye 6 cylinder 400 RPM complete (new 1941)

MOTOR GENERATORS

190 KW: 60/3/440 Synchronous, 25/80 V DC with exciters, panel, controls
1160 HP/750 KW—13,200 A.C., 250 D.C.—514 RPM—Complete
3500 KW: 60/3/13200 Synchronous, 250 V DC, with exciters

FREQUENCY CHANGERS

3125 KVA 60/3/2300—25/3/2300—complete

BOILER PLANT

300 HP 200#—gas fired—water treatment—building—stacks—excellent

TRANSFORMERS

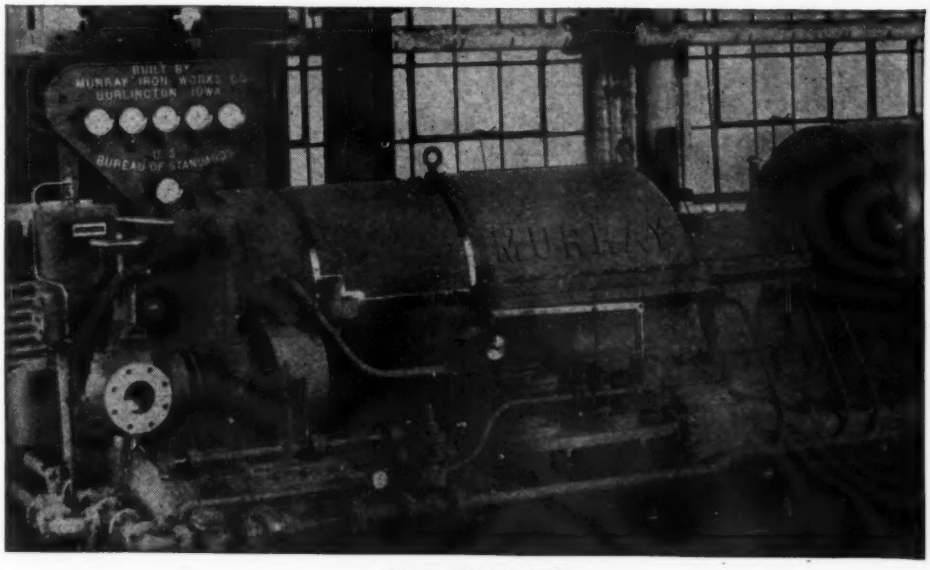
100 KVA to 4000 KVA 69, 44, 33, 22, 13.2, 2.4 KV primaries

PAUL STEWART & CO., INC.

UNION TRUST BUILDING . . CINCINNATI 2, OHIO

Over 50 Years of Service

938 KVA AUTOMATIC BLEEDER CONDENSING TURBINE-GENERATOR UNIT



Actual Photograph

AVAILABLE

Immediate Delivery

938 KVA—750 KW 80% P.F., Allis-Chalmers 3 phase, 60 cycle, 2300 volts, 3600 RPM alternating current generator direct connected to a 750 KW, 3600 RPM Murray automatic bleeder condensing turbine 200 to 300 lbs. ISP, 500°TT, 10 to 20 lbs. gauge extraction pressure complete and equipped with surface condenser, condensing auxiliaries, exciter, switchboard and instruments. EXCELLENT CONDITION — A COMPLETE INSTALLATION.

TURBINE-GENERATOR UNITS

3 Phase, 60 Cycle

2500 KVA Allis automatic extraction condensing, 200 to 300 lbs. pressure, 2300/600 volts, 3600 RPM with exciter, condenser, switchboard.

2500 KVA G.E. condensing, 150 to 200 lbs. pressure, 2300 or 550 volts, 1800 RPM complete surface condenser.

2500 KVA Westinghouse condensing, 180 lbs. pressure, 2300 volts, 3600 RPM, complete surface condenser, exciter.

1875 KVA Westinghouse condensing, 175 to 200 lbs. pressure, 500° TT, 480 volts, 3600 RPM, complete.

1563 KVA G.E. automatic extraction condensing, 150 to 200 lbs. pressure, 480 volts, 3600 RPM with shaft exciter, condenser, switchboard.

625 KVA G.E. condensing, 200 lbs. pressure, 2300 volts, 3600 RPM complete exciter, condenser, switchboard.

625 KVA G.E. non-condensing 150 lbs. pressure, 15 lbs. back, 2300 volts, 3600 RPM, complete exciter, switchboard.

375 KVA G.E. condensing, 150 to 200 lbs. pressure, 100° SH, 2300 volts, 3600 RPM, complete with surface condenser.

250 KVA G.E. non-condensing, 240 lbs. pressure, 5 lbs. gauge back, 220 volts, complete exciter and panel.

125 KVA Westinghouse non-condensing, 175 to 200 lbs. pressure, 0-10 lbs. back, 240 volts with exciter, switchboard.

125 KVA G.E. non-condensing, 175 to 200 lbs. pressure, 10 lbs. gauge back, 2300 volts, 3600 RPM complete.

100 KVA Westinghouse non-condensing, 125 to 150 lbs. pressure, 10 lbs. gauge back, 2400/600 volts, 3600 RPM.

ENGINE-GENERATOR UNITS

Alternating Current

3 Phase, 60 Cycle

500 KVA Westinghouse, 460 volts, 164 RPM generator direct connected to 26" x 28" Skinner Unaflow non-condensing engine, 140 to 160 lbs. pressure, 0 to 10 lbs. gauge back pressure.

312 KVA Elliott, 4000/2300/550 or 240 volts, 180 RPM generator, direct connected to a 17" x 24" Elliott Unaflow non-condensing engine, 175 lbs. pressure, 6 lbs. back pressure.

225 KVA E. M. 2300 volts, 200 RPM generator direct connected 19" x 24" Chuse Unaflow poppet valve engine.

200 KVA Crocker-Wheeler, 240 volts, 400 RPM generator direct connected to Ames vertical Unaflow engine, 110 to 125 lbs. pressure, 5 lbs. gauge back.

180 KVA G.E. 240/440 or 550 volts, 200 RPM generator direct connected to 18" x 21" Chuse non-releasing Corliss engine, 125 to 140 lbs. pressure.

150 KVA G.E. 240 volts, 225 RPM generator direct connected to Ames Unaflow engine.

75 KVA Allis 2300/550 or 440 volt, 257 RPM generator direct connected to 12" x 16" Chuse 4 valve non-releasing Corliss engine.

ENGINE-GENERATOR UNITS

Direct Current

325 KW 35°—400 KW max. Crocker-Wheeler 125 volt, 300 RPM generator direct connected to Skinner vertical Unaflow non-condensing engine, 135 lbs. complete switchboard.

300 KW Westinghouse, 250 volt, 900-6012 RPM non-condensing turbine-generator unit 150- to 200 lbs. pressure, 10 lbs. gauge back.

75 KW Westinghouse, 125 volt, 1800 RPM non-condensing turbine gen.

75 KW Allis-Chalmers Terry, 125 volts, 2400 RPM non-condensing turbine-generator unit.

15 KW (2) Crocker-Wheeler, 125 volts, 410 RPM generators each direct connected to an Am. Blower vert. engine.

SPECIAL OFFERINGS

1200 KVA General Electric, 3 phase, 60 cycle, 2400 volts alternating current generator direct connected to 1700 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

750 KVA Westinghouse, 3 phase, 60 cycle, 2300 volts alternating current generator direct connected to 910 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

500 KVA Westinghouse, 3 phase, 60 cycle, 600 volts, 514 RPM, belted generator.

6000 sq. ft. C. H. Wheeler surface cond.

4238 sq. ft. Allis surface condenser.

125 KW, 125 volt General Elertric direct current generator direct connected to 190 HP, 3 phase, 60 cycle, 480 volts, 1200 RPM General Electric synchronous motor complete.

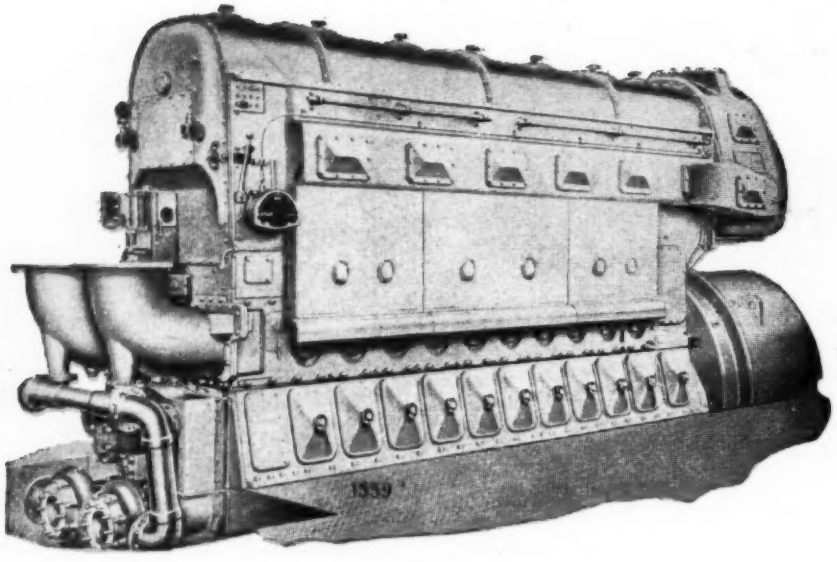
1—ALLIS-CHALMERS SYNCHRONOUS MOTOR GENERATOR SET CONSISTING OF: 1500 KW 550/600 volts, 300 RPM compound wound interpole direct current generator direct connected to a 2190 HP, 3 phase, 60 cycle, 4000 volt, 300 RPM, A.C. motor.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND 14, OHIO

WIRE OR PHONE
LONG DISTANCE 422

ENGINEERED AGSCO DIESEL POWER



THREE—

1000 KVA, 800 KW, 3 phase 60 cycle, 2300 volt. Westinghouse, 600 RPM, Direct Connected to:—

3—1250 H.P. Fairbanks-Morse Diesel Engines, Model 38D8 ⅛, 10 cylinder, 8⅛" bore, 10" stroke, 600 RPM.

These three units are offered with complete equipment—switchboards, auxiliaries cooling equipment and silencing equipment.

DIESEL GENERATORS

ALTERNATING CURRENT

KVA	MAKE	HP	MODEL	RPM	YEAR
2—1875	Fairbanks Morse	2000	33E16	300	1939
1—1250	Nelseco	1500	6M1-63	300	1931
4—1250	Fairbanks Morse	1700	38D8⅛	720	1944
12—1250	General Motors	1600	16-278-A	720	1944
3—1000	Fairbanks Morse	1250	38D8⅛	600	1944
1— 625	Superior	750	OS	327	1938
1— 312	Enterprise	450	D8G-8	450	New
1— 300	Fairbanks Morse	360	YVA	257	1928
1— 250	General Motors	300	8-268-A	900	New
4— 250	General Motors	400	8-268-A	1200	1945
6— 125	General Motors	200	3-268-A	1200	1944
1— 94	Buckeye	112	E	400	1936

WRITE FOR BULLETINS

AG

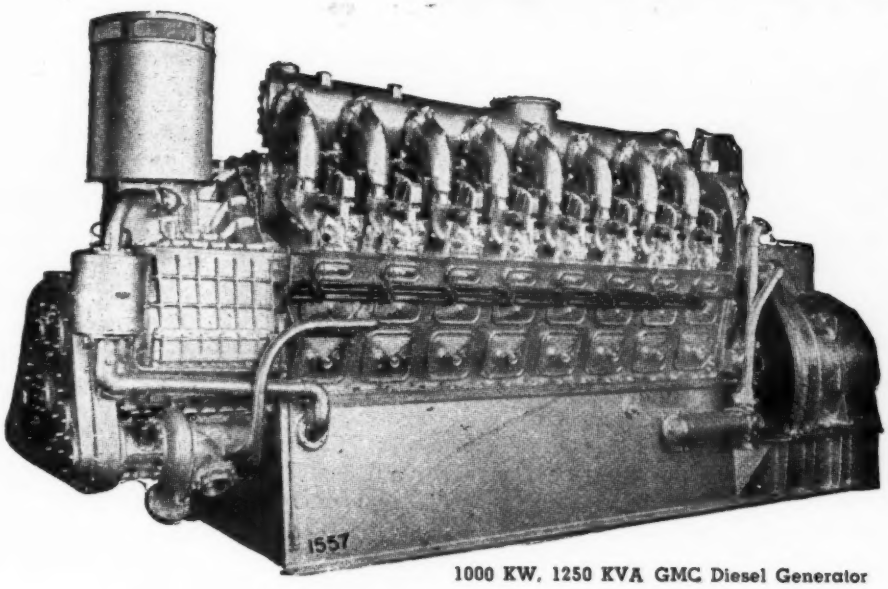
SCHOON

50 CHURCH STREET

Cable Address: AGSCOMACH

DIESEL ENGINES

ENGINEERED AGSCO DIESEL POWER



1000 KW, 1250 KVA GMC Diesel Generator

1000 KW, 1250 KVA Electric Machinery Mfg. Co. alternator, 3/60/2400, 720 RPM, direct connected to—

1600 HP General Motors Corp. Diesel engine, Model 16-278A, 2 cycle, 16 cylinders, V type, 8¾" x 10½", 720 RPM

(See data on facing page**)

OTHER IMPORTANT ALTERNATING CURRENT UNITS

KVA	MAKE	HP	MODEL	RPM	YEAR
4—75	General Motors	90	6061E	1200	New
13—62	International	75	UD18	1200	New
8—37	General Motors	45	3-71	1200	New
15—18	International	30	UD6	1200	New

DIRECT CURRENT GENERATOR SETS

KW	VOLTS	MAKE	HP	MODEL	RPM	YEAR
2—300	120/240	General Motors	450	6-278-A	750	New
1—275	120	Cooper Bessemer	440	FS-8	800	New
2—250	120/240	Enterprise	450	DSG-8	450	New
3—100	120/240	Superior	150	GDB-8	1200	New
1— 90	120	Winton	140	144	1200	1939
2— 60	120	General Motors	90	6-71	1200	1943
3— 15	120	Hill	30	4C	1200	1940
2— 12	120	Hill	25	4R	1200	1939
2— 10	120	Hill	20	4R	1200	1940

WRITE—WIRE—PHONE

MAKER CO INC.

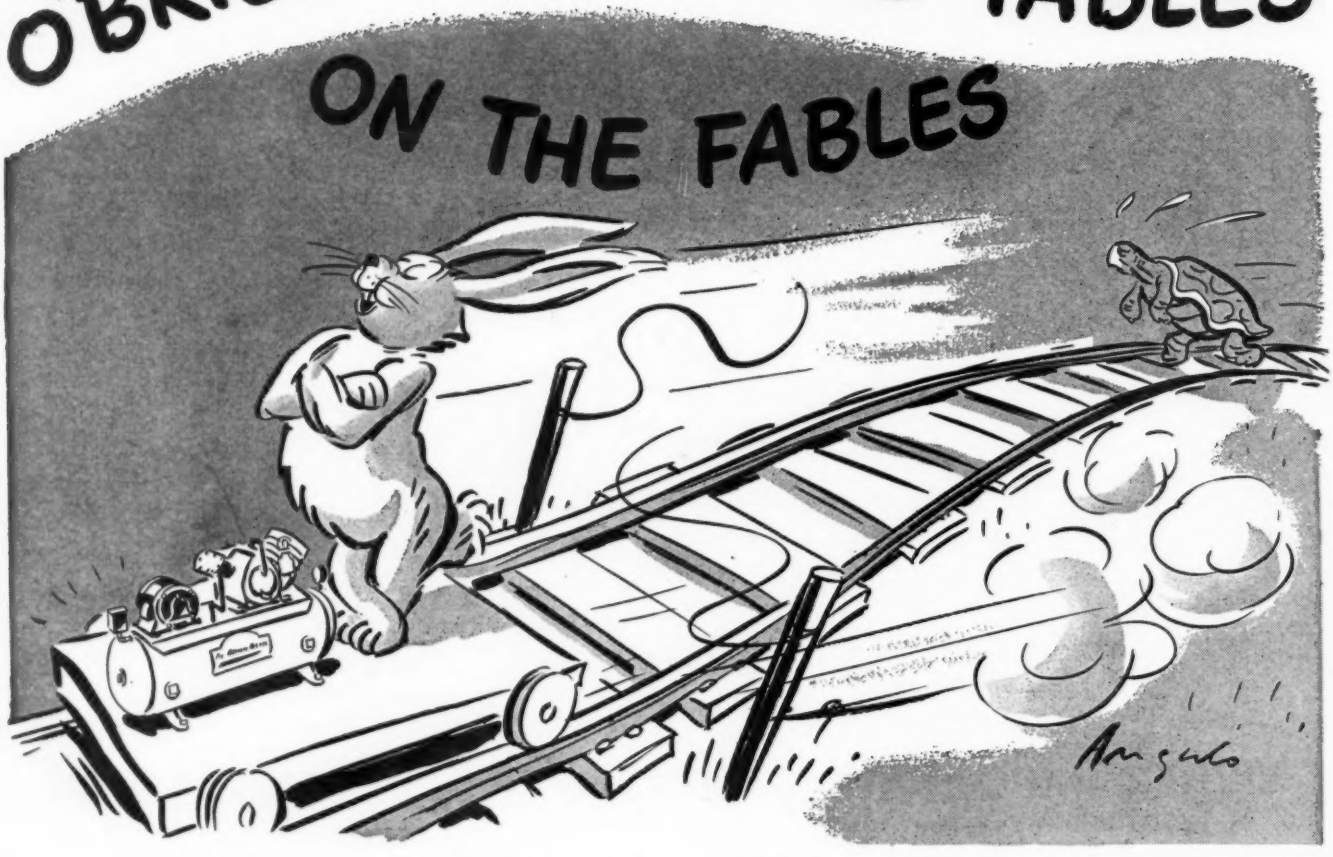
BUSINESS ESTABLISHED 1898

NEW YORK 7, NEW YORK

PHONE: WOrth 2-7225

DIESEL POWER

O'BRIEN TURNS THE TABLES ON THE FABLES



We at O'BRIEN believe, in today's mechanized age of super speeds, a modern version of Aesop's famous Tortoise and Hare fable would reverse the outcome.

At O'BRIEN, the emphasis is on speed . . . we do everything pronto! And O'BRIEN has the organization, the facilities, the experience–plus large warehouse stocks of new and guaranteed rebuilt machinery – all ready to serve you at a moment's notice. O'BRIEN's corps of skilled technicians – including graduate engineers, trained electricians and mechanics – knows the machinery business from A to Z. These men see eye to eye with the customer . . . know his problems and how to solve them; his plant headaches and how to relieve them . . . quickly and expeditiously by supplying the right machine for a specific job after a carefui analysis of the customer's machinery requirements.

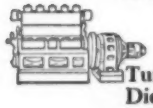
Cut the "red tape"–get in touch with O'BRIEN for ALL your machinery needs.

MANUFACTURERS AND DISTRIBUTORS

RED LINE

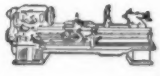
INDUSTRIAL PRODUCTS

LARGE WAREHOUSE STOCKS OF NEW AND GUARANTEED REBUILT MACHINERY



POWER PLANT EQUIPMENT

Turbo Generators – Engine Generators – Boilers – Diesel Engines – Blowers – Motor Generator Sets – Electric Motors – Air Compressors – Pumps – Heaters – Transformers – Complete Power Plants



METAL-WORKING MACHINERY

Boring Mills – Engine Lathes – Turret Lathes – Shapers – Milling Machines – Slotters – Grinders – Planers – Drill Presses – Punches – Shears – Bending Rolls – Pipe Machines – Welders – Forging Equipment

Everything from a Pulley to a Powerhouse

THE O'BRIEN MACHINERY CO.

T. M. REGISTERED U. S. PATENT OFFICE

Telephone: MArket 7-4180

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

Cable Address: OBRIEN PHILA

113 NORTH THIRD STREET • PHILADELPHIA 6, PA., U. S. A.

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SOC EXPANSÃO INDUSTRIAL SUL AMERICANA LTDA

RIO DE JANEIRO—BRASIL

POWER EQUIPMENT COMPANY

has a new home at

The items shown below is a partial listing of the equipment we now have in stock.

MOTORS—SQ. CAGE

3 Phase—60 Cycle—220/440 Volt
100 Motors up to 15 HP—all makes and types and speeds.

Qn.	H.P.	Make	Type	Speed
1	15	West.	CS	1800
1	15	G.E.	KT	1200
1	15	G.E.	KT	900
1	20	G.E.	KT 302	1800
1	20	G.E.	KT 312	1200
1	25	G.E.	KT 30N	1800
2	25	West.	CS	1200
1	25	G.F.	KT 332	900
2	25	Line.	Nema	600
1	30	G.E.	KT 312	1800
1	30	West.	CS	1800
2	30	West.	CS	1200
1	30	G.E.	KT 336	720
1	40	G.E.	KT 323	1800
1	40	G.E.	KT 336	900
1	50	G.E.	KT 327	1800
1	50	West.	CS	900
1	50	G.E.	KT	720
1	60	G.E.	KT 333	1800
1	75	G.F.	KT 337	1800
1	75	G.E.	KT	900
1	75	G.E.	IK	720
1	100	G.E.	IK	900
1	100	G.E.	KT	514
1	125	Cr. Wh.	SC	900
1	150	West.	CS	1800

Also larger Units available. Mail your inquiries.

We also carry in stock a large number of 2300 V. motors. All types, makes and speeds. Mail us your inquiries on these machines.

MOTORS—SQ. CAGE

3 Phase—25 Cycle—220/440 Volt
50 Motors in stock up to 15 HP. Send details, we will quote.

Qn.	H.P.	Make	Type	Speed
4	20	West.	CS	750
1	25	West.	CS	1500
1	25	G.E.	KT	750
1	30	G.E.	KT	750
1	40	Al.-Chal.	AR	1500
1	40	West.	CS	750
1	75	G.E.	IK	750
1	100	G.E.	IK	750
2	150	G.E.	IK	750

Also in stock many 2300 V. motors —also all types of 25 cycle Slip-ring motors, all types and makes.

MOTORS—SLIP RING

60 Cycle—3 Phase—220/440 Volt
25 Motors—in stock up to 10 HP.—All Speeds and types.

Qn.	H.P.	Make	Type	Speed
1	15	G.E.	MT	1800
1	15	G.E.	MT 312	1200
1	15	G.E.	MT 312	900
1	20	G.E.	MT 322	1200
1	20	G.E.	MT 326	900
1	25	G.E.	MT 326	1200
1	40	G.E.	MT 332	1200
1	40	G.E.	MT 336	900
1	50	West.	CW	1200
1	50	Al-Chal.	ANY	900
1	50	G.E.	MT 342	900
1	60	G.E.	MT 346	900
1	75	G.E.	MT 356	900
2	75	Al.-Chal.	ANY	900
1	75	West.	CW	900
1	75	G.E.	IM	720
1	100	G.E.	MT 356	900
1	100	G.E.	IM	720
1	150	West.	HF	600
1	150	West.	CW	600
1	200	G.E.	IM	514

Also larger Units available.

MOTORS—SLIP RING

60 Cycle—3 Phase—2300 Volts

Qn.	H.P.	Make	Type	Speed
1	75	G.E.	MT 300	900
1	100	G.E.	IM	600
1	150	G.E.	IM	600
1	200	G.E.	IM	720
1	200	G.E.	IM	600
1	300	G.E.	IM	600

All types of Slip Ring controls in stock.

DC. VARIABLE SPEED MOTORS

230 Volts

25 Motors up to 10 HP. Any speed range.

Qn.	H.P.	Make	Type	Speed
1	25	G.E.	RF 13	400/1200
1	25	West.	SK	300/1200
1	25	Rel.	131 T	800/1600
1	25	Rel.	155 T	500/1500
1	35	West.	SK	500/1500

DC—230 V.—MOTORS

50 Motors up to 10 HP., all speeds and makes. Send inquiries.

Qn.	H.P.	Make	Type	Speed
1	15	G.E.	CD	1800
1	15	G.E.	RC	1200
2	15	West.	SK	1200
1	15	West.	SK	900
1	20	West.	SK	1200
1	20	West.	SK	900
1	25	West.	SK	1800
2	25	West.	SK	1200
2	25	G.E.	RC	900
1	40	West.	SK	1200
1	60	West.	SK	1800
1	75	West.	SK	1800
1	100	G.E.	CD	1200
1	150	West.	SK	1800

MOTOR-GENERATOR SETS

1—7½ KW—GE MIC—240 V. DC 1800 RPM—AC Drive 440/60/3/1800

1—15 KW—West. SK—125 V. 1800 RPM—Factory Built—Comp. Int. on Base to 23 HP.—West. CS—Sq. Cage, 220/440-60-3-1800.

1—15 KW West. SK—250 V., DC—1800 RPM—Comp. Int. on Base to 23 HP.—West. CS—440/60/3/1800.

1—5C KW—West. SK—125 V. 1200 RPM—Comp Int. on Base to 75 HP.—West Syn Motor 220/440-60-3—1200 RPM.

POWER EQUIPMENT CO.

373 S. Goodman St.

P. O. Box 534 Tel. Hillside 2041

Rochester 4, N. Y.

AC GENERATORS

1—5 KVA Elec. Spec. Modern—220 V. 60 cy. 3 ph. 1800 RPM.—Built in exciter.

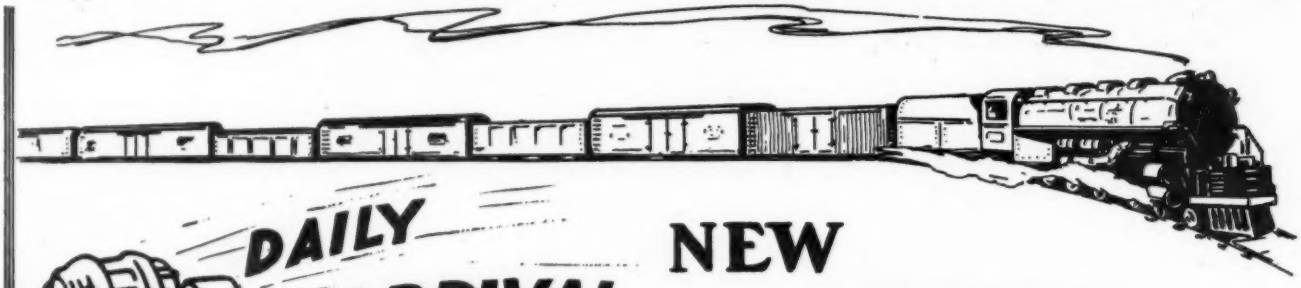
1—7½ KVA—Elec. Spec. Modern, 220 V. 60 3 ph. 1800 RPM.—Built-in Exciter.

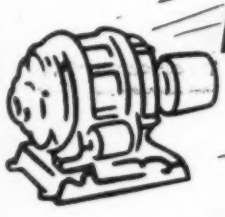
1—7½ KVA—West. AC Gen. 220/60/3/1800 RPM.—with Exciter.

1—30 KVA West. AC Gen. 240 V. 60 cy. 3 ph. 1200 RPM. Belted Exciter.

1—37½ KVA—G.E. ATB—PB-AC Gen. 240 V. 60 cy. 3 ph. 1200 RPM. With Belted Exciter.

1—112½ KVA—G.E.—ATB—PB—AC Gen. 220/60/3/900 RPM. Belted Exciter. Int. on Base to 75 H.P.—West Syn Motor 220/440-60-3—1200 RPM.





DAILY ARRIVAL NEW MOTORS

"PROMPT" REPLYS TO INQUIRIES

GEAR REDUCERS REBUILT LIKE NEW

1 link belt gear reducer output RPM .55
1 foot bros., input RPM 31.3, output ratio 58.5 to .1
3 Falk, ratio 11—1

TRANSFORMERS

Quan.	Quan.	Quan.
200 Amp—1	100 Amp—1	250 Amp—4
600 Amp—1	.162 KVA—50	1.3 KVA—7
.581 KVA—4	110 V	110 V
125 Amp—27	400 Amp—5	300 Amp—3

4 SPEEDS REBUILT LIKE NEW

2 3 H.P., 1800 RPM, Wagner, Frame 364 3/60/440
1160
870
575
5 1 H.P., 1750 RPM, Wagner, Frame 204, 440 volt, 2 speed
5 H.P., 870 RPM

NEW FOUR SPEED NEW

4 1½ H.P., 1800 RPM
½ H.P., 570 RPM
¾ H.P., 865 RPM
1 H.P., 1200 RPM
2 7½ H.P., 1750 RPM, 3 phase, 60 cycles, 440 volts, Wagner, frame 326
7½ H.P., 870 RPM, 3 phase, 60 cycles, 440 volts

PUMPS

1 F. M. with 3 H.P., 3600 RPM, dual motor
22 Pioneer—with 1/3 H.P., 1750 RPM, dual, GPM 68
4 Pioneer—with 1/4 H.P., 1750 RPM, dual, GPM 48
35 Ingersoll Rand—1/4 H.P., 1720 RPM, dual
30 H.P., FM, TEFC, type HAO, form CG 10D, 440 volt with
24 KW GE 400 Amps., 1750 RPM, model 52A715, type CD85, No. 1666213, form AL 60/60 volts.
24 KW, 400 Amps 1750 RPM, 60/60 volts, model No. 72499, type RC 314, shunt wound, 400 amps., with
30 H.P. GE, open, KT 512S, 1750 RPM, 440 volts, model No. 12E341.
15 H.P., GE, open, KT 954, 1750 RPM, 440 volts, model No. 72A717, serial No. 4979002, 300 amp, 1750 RPM, GE, form A17, 25/60 volts, No. 1555546.

REBUILT GUARANTEED LIKE NEW, NEMA FRAME

15 1 3600 TP 3/60—220/440 BB
15 125 HP, 1800 open, 3 phase, 60 cycle, 440 volt
5 200 HP, 1800 open, 440 volt
6 250 HP, 1800 open, 440 volt
10 150 HP, 1800
205 1/2 870 Wagner, AC, 220/440 volt, 3 phase, 60 cycle

USED—GEARHEAD MOTORS—USED

HP	RPM	Type	Amount
1/8	197	G.E., open, 110 volts	1
1/6	197	G.E., open, 440 volts	3
1/4		B-Line, 1 phase, TE, 110 volts, 25 cycle	1
1/4	36	G.E. 440 volts	4
1/4	86	Janette, open, 550 volts	3
1/4	17.5	G.E., open, 220/440 volts	1
1/3	17.8	G.E., slip ring, 220 volts	1
1/2	350	B-Line, TEFC, 220 volts	1
1/2	350	Master, TEFC, 440 volts	1
3/4	148	G.E., open, 440 volts	3
1	288	Master, TEFC, 220/440 volts	1
1	280	Master, open, 550 volts	1
1½	346	G.E., TEFC, 220/440 volts	1
2	312	Master, TEFC, 220/440 volts	1
20	420	Master, TEFC, 220/440 volts	

NEW NEW NEW

Open, 3 phase, 60 cycle, 220/440 volt

Quantity	HP	RPM	
15	1	900	
2	1/2	900	
3	3	900	
2	3	3600	
10	7½	900	
3	7½	3600	
10	7½	3600	550 volt
10	10	900	
8	15	900	
6	20	3600	
8	30	3600	
4	50	3600	

IN STOCK—NEW MOTORS

1/2 HP to 200 HP, 3 phase, 60 cycle, 220/440 volt, open and totally enclosed—new

NEW GEARHEAD MOTORS NEW

HP	RPM	Type	Amount
1/2	125	Splash Proof	1
1/2	9	Open	1
3/4	280	Splash Proof	3
1	190	Open	2
1	532	Open	1
1½	350	Open	2
1½	125	Open	1
1½	190	Splash Proof	2
2	350	Open	3
2	68	Splash Proof	4
2	118	Splash Proof	1
2	84	Splash Proof	3
2	125	Open	1

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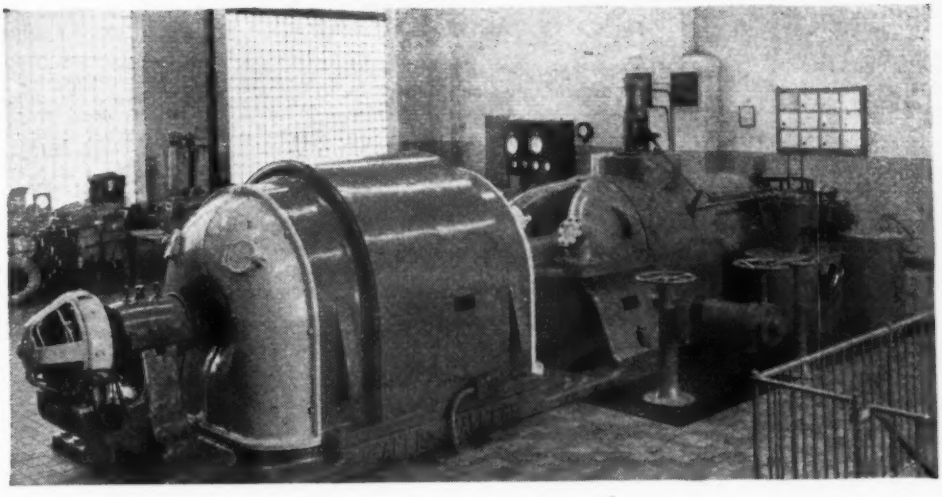
First Electric Motor & Machinery Co., Inc.

MONROE 1388-1389 P. O. BOX 1273 ROCHESTER 7, N. Y.

1132-38 MT. HOPE AVE.

TURBO GENERATORS

Diesel Engines: General Power Plant Equipment



300-lbs. ISP., 2500-KVA Allis-Chalmers Condensing Extraction 30#, Turbine-Generator.

Can be Given Running Test when Inspected

TURBINE-GENERATORS — IMMEDIATELY AVAILABLE

3750—KVA., G.E., 200#, 2300-V. Jet. Cond.
2—3750—KVA., G.E., Surf. Cond. 200#, 2300-V.
2500—KVA., West. Cond., 200#, 2300-V. Surf. Cond.
2500—KVA., Allis-C. Aut. Extr. 30#, 2300-V. 200#.
2500—KVA., G.E., Surf. Cond. 200#, 2300-V.
1875—KVA., Condensing, 200#, 2300-V.
1565—KVA., G.E., Surf. Cond., 150#, 2300-V.
2—1565—KVA., G.E., Auto. Extr. 30#, 200 ISP. 480-V.
1250—KVA., Allis-C. Non-Cond. 150#, 480-V.
1250—KVA., West. Surf. Cond., 200#, 2300-V.
937—KVA., Murray-Allis Aut. Extr., 30#, 300# ISP., 2300-V.
937—KVA., A.-C. Cond., 200#, 480-V.
937—KVA., Terry-Allis, Non-Cond. 50# BP., 200-ISP.
937—KVA., G.E., Cond. 175#, 2300-V.
937—KVA., Moore-Allis, Non-Cond. 25-BP 2300-V. 200" ISP.
937—KVA., A.-C. Non-Cond., 15#-BP. 150# ISP., 480-V.

CONDENSERS IN STOCK — IMMEDIATE DELIVERY

1—NEW 8280-sq. ft. Horizontal Surface Condenser, 2-Pass. Steel Shell. Capacity 70,000# steam per hour Top opening. Aluminum Brass Tubes, ¾"-OD., with or without Evactor. 28.5 Vacuum, with Surface inter cooler and after condenser. NEVER USED.

1—4500 sq. ft., Surface Type Condenser, 2-pass, Alberger. 1"-OD. Tubes, 28" vacuum, Capacity 36,000# steam per hour, Top opening.

Also Specialists in

DIESEL ENGINES, BOILERS, GENERAL POWER PLANT EQUIPMENT

DO YOU NEED ANYTHING NOW? SEND US YOUR SPECIFICATIONS

Have you any Turbine-Generators or other Power Plant Equipment for sale? We own Outright all machines which we offer.

CORRESPONDENCE INVITED

CHARLES WEAVER & COMPANY

Engineers

WIRE, WRITE OR TELEPHONE

4045 Penobscot Building, Detroit 26, Michigan

Telephones Cadillac 1340-1

LIQUIDATION SALE

POWER EQUIPMENT OF MODERN SHIPS

(MOST EQUIPMENT 3 TO 4 YEARS OLD)

DIESEL ENGINES

1—350 H.P. Superior Diesel Ser. #10501 & 10529, Type VD. MB, 8 cyl., Bore 9", Stroke 12", 600 R.P.M., built 1939

2—1800 H.P. Fairbanks Morse 38D 10 cylinder 8½" x 10", opposed piston, 2 cycle, 720-750 RPM (new 1943)

4—1800 H.P. General Motors 16-258S, 16 cylinder, 9½" x 12", 2 cycle, Buchi supercharged 900-750 RPM (new 1943)

2—1800 H.P. (HOR) Hamilton 9 cylinder, 2 cycle, 800 RPM, reversible (new 1944)

2—500 H.P. General Motors 8-268A, 8 cyl., 6½" x 7", 2 cycle, 1200 RPM (new 1943)

The above engines can also be supplied with fluid couplings, reduction gears and all other equipment suitable for ship installation.

DIESEL GENERATOR

4—1200 KW, DC, Allis Chalmers, 525 V. 750 RPM Driven by 1700 HP General Motors Diesel 16-278A 750 RPM (New 1943)

2—200 KW, AC, 3/60/440 and 40 KW, DC, 120/240 V Driven by 500 HP General Motors Diesel, 8-268A, 8 cyl., 6½" x 7" 2 cycle, 1200 RPM (new 1943)

1—240 KW, DC, 120/180/240 V, Driven by 500 HP General Motors Diesel 8-268A, 8 cyl. 6½" x 7" 2 cycle, 1200 RPM (New 1943)

6—60 KW DC 250 V, driven by 90 H.P. General Motors Diesel 6-71, 6 cylinder, 4½" x 5" 1200 RPM. New 1943

2—20 KW DC 250 V, driven by 30 H.P. General Motors Diesel 2-71, 2 cylinder, 4½" x 5" 1200 RPM. New 1943

2—60 KW DC Generator, 250 V, driven by 110 H.P. Buda Diesel, 8 cylinder, 4 cycle. New 1944

All auxiliary equipment can be furnished.

BOILER

8—Express Boilers, modified D type, Foster Wheeler, 30,000# steam hr., 435# press., with economizers, superheaters, desuperheaters, oil burners, etc.

CROSS COMPOUND TURBINES

2—Bethlehem 25,000 SHP each

2—General Electric 13,500 SHP each

Each turbine consists of a HP, LP, and a stern element. Units can be furnished complete with gear reducers, condensers, pumps, luboil purifiers, etc.

TURBO—GENERATORS

2—4600 KW G.E. 3 phase, 93 1/3 cycle, 2700 V, 5600 RPM (or 2900 KW, 60 cycle, 1700 V, at 3600 RPM), 410# cond., complete with 3800 sq. ft. condensers, amplidyne motor generators, circulating and condensate pumps, etc.

8—200 KW G.E. type ATB 3/60/450, 1200 RPM, 375# cond.

2—132 KW G.E. type ATB 3/60/450, 1200 RPM, 540# cond.

9—300 KW G.E. type ATI 3/60/450, 1200 RPM, 400# cond., compl. with 40 KW exciters, condensers, switchboards.

1—540 KW West'hse, 180 V, DC, 3000 Amp, 1200 RPM, 200#

1—300 KW 120/240 V.D.C. 1200 RPM, 440# cond.

12—150 KW West'hse, type SK, 120 V, DC, 1200 RPM, 225# cond.

20—60 KW West'hse, type SK, 120 V, DC, 1800 RPM, 200# cond.

NOTE: All AC generators are complete with exciters. Condensers, switchgear and other auxiliaries can be furnished.

MOTOR—GENERATORS

AC to DC and DC to AC—various sizes from 40 HP to 1 HP.

GENERATORS

28—1200 KW DC Allis Chalmers, 525 V, 750 RPM

MOTORS

6—AC 25 HP, Star, 3/60/440, 1750 RPM, type NL3651

28—DC 1500 HP, W'hse, 525 V, 600 RPM

5—DC 25 HP, 35 HP, 50 HP, type CO 1808, 230 V, all variable speed 550 RPM to 2100 RPM

500—DC, from ½ HP to 60 HP, 120 V, various speeds

18—General Electric AC synchr. motors, 3 phase, 6000 HP, 93 1/3 cycle, 2700 V, 400 RPM, or 3800 HP, 60 cycle, 1700 V, 257 RPM

SWITCHBOARDS

All sizes, AC and DC, whole or in parts, circuit breakers, current transformers, switches, meters, recorders, etc, etc.

TURBO-BLOWERS

4—West'hse type 58 ANV, 56,000 CFM at 10" S.P. turbine, 168.5 HP, 540# steam

9—Sturtevant size 24—20,000 CFM at 17" S.P. turbine, 191 HP, 400# steam

CONDENSERS

2—4568—⅝" tubes—surface 8408 sq. ft.
10—4500—⅝" tubes—surface 8463 sq. ft.
10— 400—⅝" tubes—surface 280 sq. ft.
1— 714—⅝" tubes—surface 700 sq. ft.

FEED WATER HEATERS

1—Bath Iron Wks, 95# press. 546 sq. ft.
2—Bethlehem 415 sq. ft.
10—Schutte & Koerting type L, 300 sq. ft.
12—Struth. Wells, 6 pass., H.P., 206 sq. ft.

FUEL OIL HEATERS

24—Griscom Russell sect. G-fin, 86 sq. ft.
1—Griscom Russell 4 sect., 6 fin.

BOILER FEED PUMPS, TURBINE DRIVEN

1—DeLaval 675 GPM 725# dischge., 4900 RPM, steam 540#

1—DeLaval 600 GPM 575# dischge., 4800 RPM, steam 400#

2—Worth'ton 750 GPM 375# dischge., 3500 RPM, steam 240#

5—Ing. Rand 165 GPM 575# dischge., 4850 RPM, steam 375#

3—DeLaval 125 GPM 575# dischge., 7000 RPM, steam 400#

CENTRIFUGAL PUMPS

60—Various sizes up to 15,000 GPM, up to 725# disch. pr. steel and bronze, motor and turbine driven.

RECIPROCATING STEAM PUMPS

50—Simplex and duplex, various sizes, bronze and steel

REDUCTION GEARS

3—Sturtevant des. VB-14-G, 133 HP, RPM 5720:1550

TRANSFORMERS

5—50 KVA, 15—25 KVA, 15—20 KVA; 3—10 KVA, 5— 3 KVA; from 440 V to 120 V, all single phase, 60 cycle, dry type

CENTRIFUGES

15—Sharples, 15—DeLaval, 15—20 KVA; Oil purifiers and oil clarifiers, capacity 100 GPH and 150 GPH, with motors and pump

HIGH PRESSURE AIR COMPRESSORS

2—Ingersoll Rand type 40, 4 stage, 3000# press. 20 cft. driven by G.E. 3/60/220/440 motors 50 HP

1—same, driven by Waukesha gas engine model GBZ 1111

4—Platt, 4 stage, 20 cft., 3000# press., steam or motor drive

DISTILLING PLANTS

2—Griscom Russell Soloshell double effect, 8000 gals. per 24 hours, complete with pumps

3—Cleaver Brooks Co., 5000 gals. p. day, self contained units complete with boiler pumps and fans

HOISTS

6—Mead Morrison Co., 2 drum hoisting engines type H-97, driven by 51 HP G.E. motor 230 V, DC

5—Mead Morrison Co., single drum derrick swingers type 138, driven by 5 HP G.E. motor 230 v, DC

NOTE: The above hoists are complete with controllers

2—Jaeger Utility hoists, single drum, driven by Continental 6 cylinder gasoline engine

WRITE OR CALL FOR DETAILS

HUGO NEU

31 Nassau Street · New York 5, N. Y.

Tel: REctor 2-1334

ARRANGE FOR INSPECTION

FOUR AIR COMPRESSORS

Available For Immediate Shipment

2—Schramm gas driven air compressor. Displacement 315 and 210 CFM, at a working pressure of 100#. Portable mounted on pneumatic tires with a spare set of steel wheels complete and self-contained. *Purchased in 1945.*

2—3078 CFM Ingersoll Rand Air Compressors. Type PRE, 18x30x21. 110# pressure, with after coolers and air receivers direct connected to 500 HP General Electric synchronous motor, 180 RPM, 3/60/220, .1 PF with 7½ KW MG set excitation and starting panel.
New 1942—in excellent condition.

ENGINE GEN. SETS

1—300 K.W. Chuse Vertical uniflow engine generator set, 6 cyls, 10x12, 150 lb. pressure, OBP, 450 RPM Direct Conn. to 300 K.W. G.E. Alternator 3-60-2300 V. with direct conn. exciter 125 V. Excellent condition. Rebuilt 1945. Priced Reasonable for quick sale.

1—300 KVA Engine Generator Set, Burke Alternator, 3/60/480 V, 200 RPM, direct connected to exciter and Skinner Uniflow, 150# ISP, 0-5# BP.

TURBO-GENERATORS

1—5000 KW Westinghouse Turbo-Generator, 3600 RPM, 200# pressure, condensing, 2300/3/60 complete.
1—710 HP Terry Turbine, 3600 RPM, 145#ISP, 0-60# BP, 18" x 18" centrifugal pump, rated 13,000 GPM, 170' head, 1000 RPM.
1—50 KW Westinghouse Turbo-Generator, 200# pressure, 75 HP, 7200 RPM, geared to 50# KW, 125 V DC 1200.

TURBINE

1—710 H.P. Terry Turbine, type GF, 3531 RPM, complete with reduction gear to 1000 RPM, 145# pressure, 0-60 B.P.

GASOLINE DRIVEN POWER PLANT

1—35 KVA gasoline driven power plant, complete self-contained with panel board.

MOTORS

1—1000 H.P. General Electric Slip Ring Motor, 6600/60/3, 600 RPM, with controls.
1—700 H.P. General Electric, Type KF Motor, 2300/60/3, 1800 RPM.
1—200 H.P., G.E. Synchronous Motor, 3/60/4150, 600 RPM with starting panel, V-Belted exciter. New 1943.

CENTRIFUGAL PUMPS

2—500 GPM, 360' head, Ingersoll Rand Centrifugal Pump, 1800 RPM.
1—520 GPM, 50' head, DeLaval Centrifugal Pump, 2940 RPM, direct coupled to DeLaval Turbine, 200# pressure, 0-5# B.P.
1—4500 GPM, 135' head, LeCourtney Centrifugal Pump, 1800 RPM.
1—1800 GPM, 250' head, Ingersoll Rand Centrifugal Pump, 1800 RPM.
2—520 GPM, 50' head, DeLaval Centrifugal Pump, 1150 RPM.

300 and 400 Ampere

ELECTRIC MOTOR DRIVEN ARC WELDERS

General Electric—Hobart—Lincoln

Reconditioned—Guaranteed—New 1943

AMMONIA COMPRESSORS

4—Frick 4 x 4 complete with 10 H.P., 1750 RPM, 3 phase, 60 cycle, 220/440 volt motor.

WATER STORAGE TOWER

1—100,000 Gal. Water Tank mounted on 125 ft. structural steel frame, complete with standpipe and ladders.

CARRIER AIR CONDITIONING UNIT

1—30-ton Carrier Air Conditioning Unit, Complete including Kuthabar unit. Installed new in 1944. Used one season.

BUFFALO BLOWERS

30—Buffalo size 40 steel plate Blowers Type R. Flexibly coupled to Westinghouse motors 25 HP 3/10/220/440/1750 RPM. Explosion proof. Type CS 365.

HOISTS

2—15-ton Chain Hoists with trolleys.

GEAR REDUCER

1—Foote Bros. Gear Reducer, type 6HG6, 42 to 7 ratio.

MISCELLANEOUS

1—3600 sq. ft. CR. Wheeler Surface Condenser.
2—12" LeCourtney Centrifugal bronze fitted pumps, 1800 RPM.
1—20-ton Box Crane, hand operated, 39 ft. span, complete

Heat and Power Co., inc.

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CHICAGO ELECTRIC Co.

SINGLE MOTORS ★ COMPLETE POWER PLANTS

Rebuilding ★ Redesigning ★ Buying ★ Selling ★ Rental

1318 W. CERMAK RD., CHICAGO 8, ILL., PHONE CANAL 2900

ENGINE SETS, GAS & DIESEL

75 KVA, Electric Machinery, 3/60/220/440 v. AC generator, Oil-Well Diesel 600 RPM,

31¼ KVA, Westinghouse, 3/60/208/120 v. AC generator, with LeRoi gas engine, 1200 RPM,

30 KW, Century, model 8PD, 3/60/127/220 volt, with International model UD14 Diesel, speed 1200 RPM,

15 KW, Allis Chalmers, 110 v. DC, with Wisconsin type A gasoline engine 1000 RPM,

5 KW, Jacobs Wind 32 volts, DC, with Jacobs Engine 12 HP, speed apprx. 725 RPM.

5 KW, Globe, 110 v. DC generator, with Globe gas type GE4 gas engine, speed 1150 RPM,

3 KW Marble-Card 1/60/115 AC generator, with Climax gas engine, 1800 RPM,

300 watt, Blue Diamond, 110 AC generator, connected to Pioneer, Gen-E gas engine, speed 1800 RPM,

300 watt, Electric Motor 160/120/240 volt AC generator, with Jacobsen gas engine, 3600 RPM.

GEARHEAD MOTORS A.C.

Qua.	HP	Make	Type	Output RPM
		(Single phase)		
6	⅛	Master	RA	58
3	⅓	Master	RA	29
6	⅓	Master	RA	32
		(Three phase)		
10	⅓	Master	PA	48
12	¾	Gen. Elec.	K-73	148
3	¾	Gen. Elec.	K-73	99
5	¾	Gen. Elec.	K-73	48
3	1	U.S.	GH-SFS	170
6	1	Master	PA	125
1	1	Gen. Elec.	K-203	109
1	2	NEW GE	K	100
1	3	Gen. Elec.	KT938	48
3	3	NEW GE	K	100
1	5	NEW GE	K	230
1	7½	NEW GE	K	230
3	15	Gen. Elec.	K	236

ARC WELDERS—or LOW VOLTAGE MOTOR-GENERATORS

Several 90 KW 1500 ampere, General Electric type CD DC generators, sleeve bearing, with 135 HP G.E. type TS synchronous motors 2300/440 volts, speed 1200 RPM.

MOTOR-GENERATOR SETS

KW	Make	AC	DC
1000	Wtg.	3/60/13200	250
1000	G.E.	3/60/2300	600
500	G.E.	3/25/6600	250
300	G.E.	3/60/220	250
150	G.E.	3/60/2200	275
100	G.E.	3/60/2300	250
75	G.E.	2300 gen.	110
75	Wtg.	3/60/440	250
50	C. Wh.	240 gen.	230
35	Ideal	3/60/440	125
15	C. Wh.	3/60/220	24
15	Columb.	3/60/440	45
10	Hertner	3/60/220	90/180
5	Hertner	3/60/220	90/180
5	Reliance	60/220	120
3½	G.E.	3/60/220	125
¾	Wtg.	3/60/460	115

3—UNIT M.G. SETS

KW	Make	AC	DC
40	G.E.	3/60/440	110/220
50	Cr.W	3/60/440	110/220

BALANCER SETS

2—12½ KW machines each 125 volts Crocker Wheeler, 1300 RPM,

2—12½ KW machines each 125 volts G.E. Sprague, 1400 RPM,

2—7½ KW machines, each 125 volts Cr. Wheeler, 1300 RPM.

25 CYCLE MOTORS

HP	Make	Type	Speed
60	Wtg.	CS	715
50	G.E.	KT	1450
30	Wtg.	CS	1450
25	G.E.	KT	1500
20	Wtg.	CS	1450
20	Burke	EM	750
7½	Westg.	CS	1500
7½	Burke	EM	500
5	L. Allis	A	1450
2	G.E.	KT	1500

SLIPRING MOTORS

HP	Make	Type	Volts	Speed
1000	Westg.	HF	2300	360
600	G.E.	IP	6600	300
275	Al. Ch.	ANY	440	1170
200	G.E.	IM	550/2200	600
100	Westg.	Vert.	2200	1200
100	Westg.	HF	220/440	720
50	G.E.	MT	440	860
40	G.E.	MTC	220	1160
40	G.E.	MT	440	860
35	G.E.	M	220	1200
35	F. Morse		220	1800
35	G.E.	M	220	900
35	G.E.	M	440	1140
35	Westg.	CW	440	1200
30	Ideal	AV	220/440	1160
30	Star		220/440	920/360
30	G.E.	MT	220	570
25	G.E.	L	220	600
25	G.E.	IM	220	855
25	G.E.	IM	440	855
15	Westg.	CW	440	600
11	G.E.	ITC	440	920
10	G.E.	MT	220	1145
10	G.E.	IM	440	600

POWERHOUSE EQUIPMENT

GENERATING UNITS A.C. & D.C.

1—General Electric Steam Turbine condensing. 3000 KW 1800 rpm 180 psi 2300/3/60

1—Westinghouse Steam Turbine condensing. 1000 KW 1800 rpm 125 psi 2300/3/60

1—Westinghouse Steam Turbine non-condensing. 62.5 KVA 7200/1200 rpm 150 psi 240/3/60

1—Goldie McCulloch Steam Turbine non-condensing. 200 KW 2200 rpm 150 psi 110/220 D.C.

1—Babcock Wilcox Steam Engine. 62.5 KVA 125 psi 550 or 440/3/60

1—Goldie McCulloch Steam Engine 75 KW 150 psi 15 D.C.

1—Allis Chalmers Steam Engine. 100 KW 150 psi 230 D.C.

GENERATORS

No.	Mfr.	Rat'g.	RPM	Volts
2	Gen. Elec.	300	720	13200 or 2200 or 440/3/60
1	Westinghouse	120	900	480/3/60
4	Westinghouse	81	300	2300/3/60
1	Gen. Elec.	225	900	2300/3/60
1	Gen. Elec.	187	900	2300/3/60
1	Cr. Wh.	400	350	575 D. C.
1	Gen. Elec.	250	720	550 D. C.

PUMPS—BOILER FEED

No.	Type	Size
1	Horiz. duplex	16x9x12
1	Horiz. duplex	8 & 12x8½x10
1	Horiz. duplex	6x4x7
1	Horiz. duplex	6x4x6

TRANSFORMERS

3—400 KVA 11000/1/60 to 2200/440/1/60
3—333 KVA 11000/1/60 to 2300/1/60
3—150 KVA 2300/1/60 to 440/220/1/60

VERTICAL PUMP MOTOR MOTORS A.C. 3 PH. 60 cycle

No.	Mfr.	Type	HP	RPM	Volts
1	G.E.	Sq. cge.	650	300	2200
1	G.E.	Sq. cge.	375	720	2200
1	G.E.	Sq. cge.	200	600	2200
1	F.M.	Sq. cge.	75	900	2200
1	G.E.	Sq. cge.	30	900	550
1	Wshse.	Sq. cge.	30	850	550
1	A.C.	Sq. cge.	30	850	220
1	G.E.	Slipring	360	875	6300
1	G.E.	Slipring	150	600	550
1	Wshse.	Slipring	100	580	550
1	Fbks.	Slipring	100	575	550
1	Wshse.	Slipring	75	500	550
2	G.E.	Syn	436	720	13200 or 2200 or 440
1	G.E.	Syn.	300	900	2200
1	G.E.	Syn.	225	900	2300
1	G.E.	Syn.	200	900	2300

PUMPS CENTRIFUGAL

No.	Size	Capacity	Head	
1	20	10000 igpm	95′	
1	12	1500 igpm	200′	
1	16	1200 igpm	160′	Deep Well
1	6	1200 igpm	130′	
3	6	1200 igpm	46′	
1	6	1000 igpm	70′	

BOILERS

2—Babcock Wilcox water tube 500 HP 175 psi.

MISCELLANEOUS

9—Heavy punches—1″ hole through ¾″ plate
6—sets transfer tables for above.

PUMPS TURBINE DRIVEN

No.	Size	Capacity	Head
1	3″	200 igpm	330′
2	3″	180 igpm	462′
1	2″	100 igpm	460′

ENGINE DIESEL

1—Ruston 250 HP 300 rpm
1—Crossley 165 HP 350 rpm
1—Vivian 120 HP 600 rpm
1—Glennifer 60 HP 900 rpm
2—Venn Severn 125 HP 300 rpm

ENGINES STEAM

1—Bellis Morcom 600 HP 350 rpm

TURBINES STEAM

1—Terry 200 HP 1500 rpm

TURBINES HYDRAULIC

Type	Head	Output	Speed
Pelton	650	275	600
Pelton	650	200	800
Pelton	650	200	720
Pelton	650	175	720
Pelton	650	150	900

COMPRESSORS

Mfr.	Deliv'y	Speed	Drive
Lardlaw	3000	150	Syn. Motor
Ingersol Rand	2000	300	Syn. Motor
Bury	800	150	Syn. Motor
Ingersol Rand	450	185	None
Holman	410	720	Diesel
Ingersol Rand	265	330	Diesel

HANDLING EQUIPMENT

3—Loco Cranes 15 ton @ 12′ rad.
1—Loco Crane 10 ton @ 12′ rad.

ALL ITEMS IN STOCK FOR IMMEDIATE DELIVERY. WRITE, WIRE OR PHONE YOUR ENQUIRIES ON GENERAL POWER HOUSE EQUIPMENT. WRITE FOR OUR COMPLETE LISTING.

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THE PICK OF POWER EQUIPMENT

TURBINE UNITS—60 Cy.

1—4000 KW General Electrical Cond.
1—3750 KVA Westinghouse Extrac.
1—3125 KVA General Electric Cond.
2—3125 KVA General Electric Extrac.
1—2500 KVA General Electric Cond.
1—1875 KVA Westinghouse Cond.
1—1875 KVA Westinghouse Non-C.
1—1563 KVA Westinghouse Extrac.
2—1250 KVA General Electric Cond.
1— 625 KVA General Electric Cond.
1— 225 KVA General Electric Non-C.

STEAM ENGINE UNITS—60 Cy.

1—900 KW Hamilton Uniflow
1—750 KVA Chuse Uniflow
1—500 KVA Chuse Uniflow
1—375 KVA Harrisburg Uniflow
1—325 KVA Skinner Uniflow
1—312 KVA Ames Uniflow
1—300 KVA Skinner Uniflow
1—225 KVA Skinner Uniflow
1—150 KVA Ames Uniflow

D. C. STEAM ENGINE UNITS

1—600 KW Ames Uniflow, 250 V.
1—500 KW Ames Uniflow, 250 V.
1—400 KW Ames Uniflow, 250 V.
1—350 KW Ridgway Uniflow, 250 V.
1—300 KW Skinner Uniflow, 275 V.

DIESEL ENGINE UNITS

2—1600 HP Gen. Motors, 2400 V. 60 cy. gen.
1— 750 HP Worthington, 450 V. 60 cy. gen.
1— 625 HP Worthington, 240 V. 60 cy. gen.
1— 500 HP Gen. Motors, 480-2400 V. gen.
1— 300 KW Buckeye, 450 V. 60 cy. gen.
1— 300 HP McIn. & Sey., 480 V. 60 cy. gen.
2— 250 HP Gen. Motors, 460 V. 60 cy. gen.
1— 150 HP Buckeye 400 RPM eng. only.
2— 30 KW Buda 6DTG-317, 3-60-127/220 V.
6— 15 KW Int. Har. UD-6, 3-60-127/220 V.

WATER TUBE BOILERS

2—1409 HP B. & W. 650-lb., Stokers
2— 560 HP Erie City 460-lb.
1— 519 HP Titusville 200-lb., Stoker
5— 492 HP Heine 180-lb., Stokers
2— 469 HP B. & W. 425-lb., Pulverizer
2— 323 HP Springfield 225-lb., Stokers

SYNCHRONOUS MOTORS

1—400 HP Al. Ch. 60 cy. 2300 V. 514 RPM
1—300 HP G. E. 60 cy. 2200 V. 600 RPM 3-bearing
1—300 HP West. 60 cy. 2300 V. 900 RPM
1—200 HP West. 60 cy. 2300 V. 900 RPM
1—100 HP G. E. 2300 V. 240 RPM (Super)

INDUCTION MOTORS—60 Cy.

3—6000 HP G. E. 2300 V. 90 RPM
1—1000 HP West. slip ring 2200 V. 360 RPM
1— 800 HP G. E. sl. rg. 2200 V. 450 RPM
1— 500 HP G. E. sl. rg. 2200 V. 3600 RPM
2— 200 HP West. sq. cage 220/440 V. 900 RPM
2— 120 HP G. E. sq. cage 220 V. 3600 RPM

MOTOR GEN. SETS

1—1500 KW Allis Chal. 600 V. DC, 60 cy.
1—1000 KW Gen. Elec. 600 V. DC, 60 cy.
1— 400 KW Allis Chal. 275 V. DC, 25 cy.
2— 300 KW Allis Chal. 275 V. DC, 25 cy.
1— 300 KW Westinghouse 250 V. DC, 60 cy.
1— 250 KW Allis Chal. 275 V. DC, 25 cy.
1— 50 KW Westinghouse 250 V. DC, 60 cy.

ROTARIES—60 Cy.

1—2000 KW Allis Chalmers 600 V.
1—2000 KW General Electric 600 V.
2—1500 KW Westinghouse 250 V.
1—1000 KW Allis Chalmers 600 V.
1— 750 KW Westinghouse 275 V.
1— 750 KW General Electric 600 V.
1— 500 KW General Electric 275 V.
1— 500 KW Westinghouse 275 V.

FREQUENCY CHANGERS

1—2150 KVA G. E. 25/62½ cy. 750 RPM
1—1875 KVA G.E. 25/60 cy. 300 RPM
1—1250 KVA West. 25/60 cy. 300 RPM
2—1000 KVA G. E. 25/60 cy. 300 RPM
1—1000 KVA Al. Chal. 25/62½ cy. 375 RPM
1— 938 KVA West. 25/62½ cy. 750 RPM
1— 600 KVA G. E. 60/25 cy. 300 RPM

TRANSFORMERS—1 Ph. 60 Cy.

1— 6667 KVA G.E. 79660/138,000-34500 V.
2— 2000 KVA West. 69/34.5-4.8/2.4 KV.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
1— 333 KVA Al. Ch. 25410/44000-13200/23000Y V.
3— 150 KVA G. E. 33000-11000 V.
3— 50 KVA G. E. 33000-2300 V.
1—10000 KVA West. 26400-4580 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
3— 1500 KVA G. E. 22500-550 V. 1 ph. 25 cy.
3— 1000 KVA West. 26400-4150 V.
1— 1000 KVA G. E. 24000-11500 V. 3 ph.
2— 1000 KVA G. E. 23000/11500-575 V.
2—10000 KVA. Pitts. 13200-4600 V. 3 ph.
1— 3000 KVA West. 13803-2400 V. 3 ph.
1— 1250 KVA G.E. 13800/27600-2300 V. 3 ph.
2— 1000 KVA G.E. 11500-23000-575 V.
3— 400 KVA G.E. 11500-2300 V. 1 ph.
3— 150 KVA West. 7200/12470Y-120/240 V.
2— 1500 KVA West. 4000-2300 V. 3 ph.
1— 300 KVA West. 450-100 V.

OIL CIRCUIT BREAKERS

2—	800 A. 87 KV A.B.B. AF22	Outdoor
2—	800 A. 73 KV G.E. FHK039	Outdoor
2—	400 A. 25 KV G.E. FK0136	Outdoor
2—	1000 A. 23 KV Kelman CB76	Outdoor
4—	600 A 15 KV G.E. FHK0139-24BS	Outdoor
1—	600 A. 15 KV G.E. FK037	Pole Type
1—	600 A. 15 KV West. O-221	Outdoor
2—	400 A. 15 KV G.E. FHK0136	Outdoor

PARTIAL LIST — WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street New York City 7, New York

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

1—10000 KW. 11000 V. Cond.
2— 3000 KW. 600 V. Cond.
1— 2500 KW. 2300 V. Cond.
1— 2000 KW. 600 V. Cond.
1— 1250 KW. 2300 V. Cond.
1— 1000 KW. 2300 V. Cond.
1— 625 KW. 2300 V. Cond.
3— 500 KW. 2300 V. Cond.
1— 500 KW. 240 V. Cond.
2— 100 KW. 115 V. D. C.

ENGINE GENERATORS

2—600 KW. 2300 V. Uniflow
1—400 KW. 440 V.
1—168 KW. 600 V.
1—250 KW. 480 V.
1—150 KW. 480 V.
1—125 KW. 125/250 V. D.C. Uniflow

TURBINES ONLY

1—375 H.P. with gears
1—210 H.P. Terry 250#
5— 56 H.P. 1600 RPM, new

BOILERS

1—1390 H.P. 400# Coal
1— 990 H.P. 200# Coal
1— 750 H.P. 150# O.I.
2— 507 H.P. 180# Coal
1— 360 H.P. 190# Coal
2—100 H.P. 100# Oil
1— 200 H.P. HRT 160#

AIR COMPRESSORS

1—6000 CFM 150# Motor
1—1972 CFM 100# Motor
1—1573 CFM 100# Motor
1—1300 CFM 50# Steam
1—1700 CFM 100# Steam
1— 600 CFM 350# Steam
1—5000 CFH 600# Belted
1—1000 CFH 3000# Belted

PUMPS

1—Vacuum, Size 14"x22"24" Steam Driven
1—3000 GPM 65' Head, Motor Driven
1—600 GPM, 162' Head Motor Driven

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The buyer Must Be Satisfied—Always

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ROSS HEAT EXCHANGERS

TYPE BCF

BCF LUBE OIL COOLERS

"YOUNG" RADIATORS

42" x 65"

ALL NEW. Ready for immediate shipment

ALJON DIESEL CO., INC.

904 Pacific St. Brooklyn 16, N. Y.

BOILER TURBINES

2—400 H.P. Erie City, type-E, stokers, OHIO, PENNA'A & ASME stamping.

2—400 H.P. Springfield, oil burners, N. J. & ASME stamping.

2—25,000#, per hour, 425#, 650 T.T. boiler & turbine complete plant (1) 1500 KW. bleeder, (1) 1500 K.W. back pressure turbo's, National Board boilers.

1—1000 K.W. turbine unit complete with switch board, seen operating, immediate delivery.

H. P. BREARLEY

3423-91st Street

Jackson Heights, N. Y.

MOTORS—M. G. SETS—CONTROL

In Stock—Immediate Shipment—Rebuilt & Guaranteed

230-VDC CRANE & MILL MOTORS

H.P.	Make	Type	R.P.M.
(1) 1	P. & H.	5½ x 3½	850
(6) 3½	G.E.	C.O.-1803	700
(4) 5	G.E.	MD-101	825/975
(1) 6	G.E.	C.O.-1805	1150
(1) 9	G.E.	M.D.-102(C.P.)	975
(1) 10	G.E.	C.O.-1805	925
(1) 10	G.E.	C.O.-2604	700
(3) 14/19	C.W.	B.W.	675/560
(2) 14/19	C.W.	B.W. (B.X.)	675/560
(1) 13	G.E.	MD-103 (B.X.)	800
(1) 19	C.W.	SWS-15	560
(1) 21	G.E.	Type-52	345
(1) 25	G.E.	COM-1828 (C.P.)	850
(1) 30/42	C.W.	D.W.	620/520
(1) 30/45	G.E.	M.D.-104½ (C.P.)	625/500
(1) 33	C.W.	SWS-25	500
(3) 35	G.E.	C.O.-2506	650
(2) 40/50	G.E.	M.D.-105-(C.P.)	550/475
(1) 50	G.E.	MD-105 (C.P. B.X.)	500
(2) 50	G.E.	COM-1830 (C.P.)	525
(1) 52	Westghse	K-10	740
(1) 52/80	C.W.	F.W.	575/480
(1) 60	Westghse	MTA-2 (B.X.)	

ALL SERIES EXCEPT WHERE (C.P. COMPOUND WOUND) B.X. BACK AXLE

230-VDC (Variable Speed)

H.P.	Make	Type	Winding	R.P.M.
(1) 3/4	G.E.	B.D.-225	SH.	600/1800
(1) 2	G.E.	R.C.-4-2	CPD.	600/1000
(1) 3	G.E.	RLC-111	SH.	500/1500
(1) 3	G.E.	CR-3	SH.	500/1500
(1) 3	Reliance	T-14	SH.	1200/3600
(1) 4	G.E.	R.C.-5-4	CPD.	600/1000
(1) 5	G.E.	RLC-115	SH.	250/1000
(1) 5	G.E.	RF-9	SH.	450/1350
(1) 5	Westghse	SK-33	SH.	1150/1650
(1) 6	G.E.	RF-9	SH.	450/1350
(1) 6/10	G.E.	RLC-114	SH.	500/1500
(1) 7½	G.E.	RF-10A	SH.	450/1350
(1) 7½	Westahse	SK-70	CPD.	450/1800
(1) 7½	Westahse	SK-70	SH.	600/1800
(1) 7½	Westchse	SK-60L	CPD.	650/1000
(1) 8	Westhse	SK-100L	SH.	300/1200
(1) 8½	G.E.	RF-9	SH.	600/1800
(2) 9	G.E.	RF-10	SH.	400/1600
(1) 10	El. Dy.	7½S (115-Volt)		250/1000
(1) 10	Westghse	SK	SH.	250/1000
(1) 10	G.E.	RF-12	SH.	300/1200
(3) 10	Westghse	SK-90	SH.	400/1600
(1) 15	El. Dy.	10-S	SH.	450/1350
(1) 15	G.E.	RF-11	SH.	400/1600
(1) 15	G.E.	RF-10	SH.	550/1650
(1) 10/15	Al. Chal.	EB-100	SH.	575/1725
(1) 15	El. Dy.	5-S	SH.	600/1200
(1) 19	Westghse	SK-100L	SH.	600/1200
(1) 20	G.E.	RF-12	SH.	400/1200
(1) 20	G.E.	RF-12	SH.	400/1600
(1) 25	G.E.	RF-13	SH.	400/1200
(1) 25	G.E.	CD	SH.	200/ 800
(1) 35½	Westghse	SK	SH.	400/1200
(1) 35/50	Westghse	SK-160	SH.	500/ 750
(1) 50	Westghse	SK	SH.	250/1000
(1) 60	Westghse	SK-131	SH.	500/1500

(5)—100-HP. Reliance Motors, 230-VDC., Shunt, Frame 1050-T, cont. duty, 400/1200-RPM.

(1)—150/185-HP. Electro Dynamic Motor, 230-VDC., Frame 75-S, cont. duty, comp. interpole, 250/500-RPM., with Monitor Control Panel, non-rev., 4-step acceleration, resistance built into back of panel all protected.

(1)—200/250-HP. Reliance Motor, Frame T-2600, comp. interpole, cont. duty, 230-VDC., 400/800-RPM., complete with control.

We can supply control for any of the above 230-VDC. Motors consisting of Rev. or Non-Rev. with Resistors, or complete with Automatic Panels with contacts for necessary steps of acceleration.

(1) 25	G.E.	RF-13	SH.	250/1000
(1) 35	G.E.	RF-14	SH.	250/1000

Can supply these (3) Motors with G.E. Type Cr-2251 Planer Control Complete with Rheostats and Resistance for Shunt Field and Armature Rregulation.

SLIP RING MOTORS
(CONSTANT DUTY) 3-PH., 60-CY.

H.P.	Make	Volts	Type	R.P.M.
(1) 10	G.E.	220	M.Q.-1801 (2-PH)	1120
(1) 20	G.E.	220	MT-326	850
(2) 25	G.E.	2200	MT	900
(1) 30	Al. Chal.	440	ANY	900
(1) 38	G.E.	440	I.M.	1200
(1) 40	Al. Chal.	2200	ANY	450
(1) 50	G.E.	440	MT-353	900
(1) 125	Wagner	2200	B.R.	1200
(1) 200	Al. Chal.	440	ANY	585
(1) 250	Westgshe	2200	C.W.-1314	277
(1) 250	G.E.	2200	I.M.	600
(1) 300	Al. Chal.	2200	ANY	514
(1) 350	Al. Chal.	440	ANY	514
(1) 400	G.E.	440	MT-412	585
(1) 500	Al. Chal.	440	ANY	585
(1) 600	Al. Chal.	2200	ANY	585

(CAN FURNISH CONTROL WITH MOST OF THESE MOTORS)

SQUIRREL CAGE MOTORS
220/440-V., 3-PH., 60-CY.

H.P.	Make	Type	R.P.M.
(1) 1¼	G.E.	KT-180	600/1800
(1) 3¼	G.E.	KT-201	600/1800
(1) 20	G.E.	I.K.	565
(1) 20	Allis Chalmers	SQ. CG.	1130
(1) 25	F.M.	H-12-B	900
(1) 25	G.E.	K.T.-322	1170
(1) 25/12½	Westgshe	C.S.-404	1730/880
(1) 60	Westgshe	C.S.-752-C	690
(1) 60	G.E.	F.T.-527-U	3600
(2) 75	C.W.	25-Q	430

T. B. MAC CABE COMPANY

4312 CLARISSA STREET — PHILADELPHIA, PENNA.

WE OFFER THE FOLLOWING EQUIPMENT

1—20 KW, 1800 RPM, 2300 volt, 3 phase, 60 cycle, tag 8749, Ser. #353078 Electric Machinery A.C. sleeve bearing generator.

1—20 HP, 1200 RPM, 2200 volt, 3 phase, 60 cycle General Electric synchronous motor with D.C. exciter direct connected and push-pull low voltage compensator.

1—22½ KW, 1200 RPM, 2300 volt, 5.64 amp., 3 phase, 60 cycle, type AB, tag 9436, Ser. #50501 Fairbanks Morse A.C. Generator.

1—25 KVA, 1200 RPM, 120/208 volt, four wire, 60 cycle New American Generator with direct connected exciter.

1—30 HP, 1200 RPM, 2200 volt, 3 phase, 60 cycle General Electric synchronous motor with D.C. exciter direct connected with push-pull low voltage compensator.

1—37½ KW, 1200 RPM, 2400 volt, 9 amps. per term. 3 phase, 60 cycle, tag 9340, Ser. #353288 Electric Machinery Alternator.

1—62½ KW, 225 RPM, 2400 volt, 15 amp., 3 phase, 60 cycle, tag 9584, Ser. #353996 Electric Machinery Generator.

1—75 KVA, 900 RPM, 1150 volts, 37 amp., 3 phase, 60 cycle, type TRB, tag 9623, Ser. #15921 Wort Wayne Generator.

1—75 KVA, 300 RPM, 2300 volt, 14 amp., 3 phase, 60 cycle Westinghouse umbrella type generator with direct connected exciter, connected to 118 HP Lephal wheel 23 feet ahead, Woodward governor and complete switchboards containing oil breakers, voltage regulators, currents, rheostats, A.C. and D.C. voltmeter and ammeter.

1—75 KW, 1200 RPM, 2300 volt, 18.75 amp., 3 phase, 60 cycle, type TRB, frame B, Ser. #301191 General Electric generator.

1—125 HP, 225 RPM, 220 volt, 262 amp., 3 phase, 60 cycle, type TS, tag 9023, Ser. #4530043 General Electric Synchronous motor.

1—125 KW, 720 RPM, 480 volt, 150 amp. tag 9442, Ser. #403031 Electric Machinery generator.

1—160 HP, 400 RPM, 5000 volt, 3 phase, 60 cycle, 18.5 amp., type ATB-18-160-400, form 8, Ser. #85785 General Electric synchronous motor with 7 KW Northern Electric D.C. exciter 120 volt, 800 RPM.

PORTER ELECTRIC COMPANY, INC.

330 South Sixth Street — GEneva 8655 — Minneapolis 15, Minn.

ELECTRICAL EQUIPMENT COAST TO COAST

REBUILT POWER EQUIPMENT

READY TO SHIP!

ALTERNATING CURRENT MOTORS

3 ph., 60 cy.

H.P.	Make	Volts	R.P.M.	Type
1	Wagner	220	1140	Sq. Cage
2.25	Northwestern	440	1080	HEW 1½ Slprg
5	Westg.	220 or 440	850	CS Sq. Cage
7½	Westg.	220	1150	C—Sq. Cage
10	Louis Allis	220/440	1730	FX Sq. Cage
20	Westg.	440	860	CS—Sq. Cage
25	Allis Chal.	220	685	Sq. Cage
50	Westg.	220/440	895	Slipring
60	Al. Ch.	220 or 440	1165	ART.—Sq. Cage
100	Cr. Wh.	200	700	Slipring
100	Fynn Weischel	220/440	900	31V-RN Sq.Cage
200	Allis Chal.	2200	505	Slipring
300	.....	2200	600	CW Slipring
400	Westg.	2200	435	CW Slipring

COMPRESSORS

2—315 cu. ft. 100# pres. Ingersoll Rand Models 315 and 315A Portable Air Compressors with 105 HP. Waukesha Oil Engines complete with accessories.

1—610 cu. ft. 100# pressure Burry Horiz. Compressor.

VARIABLE SPEED MOTORS

230 VOLT D. C.

H.P.	Make	R.P.M.	Type
20	Westg.	400/1600	SK
15	Westg.	875/1600	SA
10/15	Electro Dy.	600/1200	
10	Westg.	800/1600	SA
10	Cr. Wh.	690/895	CMC
10	J. C. Curran	950/1230	
10	G.E.	625/1250	I.C.
10	Westg.	400/1600	SA
7½	G.E.	450/1350	RF
4	G.E.	850/1700	LC-8
3	G.E.	400/1200	RLC-114
3	Roth	500/1000	RS

SERIES WOUND MOTORS

H.P.	Make	Volts	R.P.M.	Type
50	Northern	220	600	K
35	Westg.	230	550	49D
32	Shaw	230	485	5L2F
15	Westg.	220	650	RL
15	Cr. Wh.	220	270	SM
10	Westg.	230	750	MT-00
7½	Westg.	230	975	S
3½	Westg.	230	1200	LM

230 VOLT DC MOTORS

H.P.	Make	R.P.M.	Type
¼	Triumph	525	14-F
½	Bodine	3400	
1½	Master	3450	DM
1.5	Louis Allis	1750	NA
2	Westg.	1180	CD
3	Western Elec.	1125	E-20-R
3½	Westg.	975	S
4	G.E.	850	LC-8
5	Westg.	1150	SK
7½	G.E.	1700	RC
8	G.E.	950	RC-11
10	Cr. Wh.	850	CM
12	Northern	1475	
15	Allis Chal.	800	
20	Westg.	600	M
20	Westg.	975	S-6
25	G.E.	650	MD
25	Westg.	825	SK113
35	G.E.	700	DLC

D. C. CLARK CONTROLLER

1—250 HP Clark Vari Time magneto controller 230 v. DC reversing, used for plugging service. Can also be used for non-reversing.

MOTOR GENERATOR SETS—

250 & 500 V. D. C.

1—25 KW. 1150 rpm. 250/275 v. Westg. SK Generator direct connected to a 220/440 v. Motor.

1—125 KW 250 v. compound wound Ridgway Generator 900 rpm. direct connected to a 225 HP. 2200 v. 3 ph. 60 cy. Ridgway synchronous motor.

1—100 KW. 900 rpm. 550 v. Westg. Generator coupled to a Westg. 2300 v. 3 ph. 60 cy. synchronous motor.

1—65 KW. 125 v. DC General Electric Generator dir. driven by a 100 HP. 1200 rpm. 2200 v. AC Motor.

1—3 KW 1350 rpm. 250 v. type 8 Westg. Gen. dir. conn. by coupling to HP 1350 rpm. 110 v. Westg. Mtr.

INDUSTRIAL TRUCKS

5—Automatic type LO-5 Low Lift Trucks capacity 5 ton, platform type. Equipped with towing coupler and bumper for pushing cars.

6—New 4 ton Yale & Towne model Y8W Multi-Stroke Hand Lift Platform Trucks.

PUMPS

1— 135 gpm. 53 ft. head Allis Chalmers Pump.
1— 400 gpm. 90 ft. head Allis Chalmers Pump.
1— 600 gpm. 32 ft. head Dayton Dowd Pump.
1— 750 gpm. 20 ft. head Dayton Dowd Pump.
1— 750 gpm. 70 ft. head Dayton Dowd Pump.
1—1200 gpm. 110' head Allis Chalmers Pump.
1—2000 gpm. 170 ft. head De Laval Pump.
1—3500 gpm. 130 ft. head De Laval Pump.
1—4000 gpm. 90 ft. head De Laval Pump.
1—5600 gpm. 143 ft. head Alberger Pump.
1—8000 gpm. 100 ft. head American Well Works Pump.

WRITE, WIRE OR PHONE YOUR ELECTRICAL NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

MOTORS • GENERATORS • TRANSFORMERS

MOTORS

3 phase—25 cycle—220/440 volt

H.P.	Make	Type	Frame	RPM
5	West.	CS		750
5	West.	CS		750
5	West.	CS		750
5	West.	CS	453	750
5	West.	CS	453	750
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
10	G.E.	KT	312	750
15	G.E.	I Form K		750
15	West.	CS	573	750
20	West.	CS		730
25	West.	CS		730
40	G.E.	I Form K		750
75	G.E.	I Form K		500
100	G.E.	I Form K		750
100	West. (2200 v.)	CS	871.52C	1460
125	West. (S.R.)	CW		480
150	G.E.	I Form K		365
150	G.E. (2200 v.)	I Form K		750
150	G.E. (2200 v.)	I Form K		750
150	Allis Ch.	Slip Ring		720
150	G.E. (2200 v.)	KT b.b.	557Y	1470
200	West. (2200 v.)	CS	1013	480
200	G.E. (2200 v.)	I Form K		485
200	G.E. (S.R.)	I Form M		480
200	West. (S.R.)	CW	1011	480

MOTORS

3 phase, 60 cycle, 220/440 Volts

HP	Make	Type	RPM	Serial No.
15	Westinghouse	CS	1200	1883285
15	Westinghouse	MS	1200	9445931
20	Westinghouse	CS	1200	2160500
20	Westinghouse	MS	1200	1050826
20	Westinghouse	CS	1800	1863526
20	Westinghouse	CS	1800	2695044
20	Westinghouse	CS	1200	2160590
20	Westinghouse	MS	1200	1056826
20	Westinghouse	CS	1800	1863526
25	Westinghuse	MS	1800	1562026
25	Westinghouse	CS	1200	2386768
25	Westinghouse	MS	1200	1197673
25	Wagner	BP	1200	126906
25	Westinghouse	MS	1800	1562026
25	Westinghouse	MS	1800	1334763
25	Westinghouse	CS	1200	2286768
25	Westinghouse	MS	1200	1197673
25	Wagner	BP	1200	126906
30	Westinghouse	MS	1200	1197674
30	Fairbanks-Morse	V-H-10D	1800	43476
40	Westinghouse	CS	900	1896969
40	General Electric	I-K	1800	73318
40	Westinghouse	MS	1800	1506806
40	General Electric	I-K	1200	181444
40	Westinghouse	MS	1200	1027421
40	General Electric	I-K	1800	73316
40	Westinghouse	CCL	1800	1506800
40	General Electric	I-K	1200	181444
50	Westinghouse	CS	1800	1949877
50	Westinghouse	MS	1800	1289389
50	Westinghouse	MS	1200	854410
50	Westinghouse	CS	1800	2691183
50	General Electric	14	1800	181444
50	General Electric	KT-352	720	
50	Allis Chalmers		1800	3K28825
60	Reliance		1200	B11458
60	General Electric	I	1800	292596
60	Westinghouse	CCL	1800	329654
60	Robbins-Myers	K	1800	P515362
60	Triumph		1800	C14248
60	Westinghouse	CCL	1200	854121 (2200 v.)
60	General Electric	I	1800	292596
60	Westinghouse	CCL	1800	329654
60	Whse. 2200V.	CCL	1200	854121
75	Westinghouse	CS	1800	2134671
100	Westinghouse	CCL	1200	
100	Westinghouse	CCL	1800	1043213
100	Westinghouse	CCL	1800	1043213
100	Westinghouse	CCL	1800	765231 (2200 v.)
125	Westinghouse	CS	1200	2318625
125	Westinghouse	CCL	1800	765231
125	Westinghouse	CS	1200	2318625
150	Westinghouse	CS	1800	2429726
150	General Electric	I-K	1200	
150	Whse. 2200V.	CCL	720	808349
150	Westinghouse	CS	1800	2429726
250	General Electric.	I-K	600	2246834

230-VOLT D.C. VAR.

HP	Make	Type	RPM
1½	Westghse. (9)	SK	740/2200
1½	G.E.	RA6	500/1500
1½	Westghse.	SK	1150/2200
2	G.E.	RC24	2040
2½	G.E. (2)	RA30	400/1350
2½	Westghse.	SK	450/1800
3	G.E. (5)	CD55	850/1350
3	G.E.	CD	850/1350
3	G.E.	DD55	850/1350
3	G.E.	CD	850/1350
3½	Westghse.	SK	450/1600
3½	Westghse.	SK	450/1800
3½–4½	Westghse. (4)	SK	175/1800

H.P.	Make	Type	RPM
3¼	Sprague	M2 Crane	655
3½–5½	Westghse. (2)	SK	500/1500
3½–7½	Westghse. (2)	SK	450/1500
3½–6¾	Westghse. (4)	SK	450/1500
3½–7½	Westghse.	SK	450/1500
5	Star	SB3	1150
5	Westghse.	SK	1600/2800
5	Reliance		500/1000
5	G.E.	RF9	450/1800
5	G.E.	CD55	1750
5½	Westghse. (22)	SK	500/1500
5	Westghse.	SK	500/1500
5½	Westghse.	SK	400/1600
7½	Westghse.	SK	500/1500
7½	Westghse. (4)	SK	1340/2680
7½	G.E.	CVC113	1675
7	G.E.	RF10	400/1600
7½	G.E.	CD55	1750
10	Westghse.		1200/1800
10	G.E.	LC	750/1200
10	G.E. (3)	LC	750/2000
10	G.E.		425/1275
10	G.E.		400/1200
15	G.E.	1026	800/2700

MOTOR GENERATOR SETS

1—30 KW. Gen. Elec. Generator Type DLC-203, 125 v. direct connected to 40 HP Gen. Elec. Motor, 3/440/60/720 RPM, with panel board.

1—10 K.W. Gen. Elec. Generator Type ML, 125 v. direct connected to 15 HP Lincoln motor, 3/60/440/1200 RPM, with panel board.

AIR COMPRESSOR

1—1000 CFM, 125 lb. pressure Worthington feather valve, 2-stage compressor. Immediate delivery.

2—5000 CFM, Worthington 45# low pressure. Complete with 500 HP. Gen. Elect. Synchronous motors, 3 Ph. 25 Cy. 2300 Volts.

PRIMARY CONTROLS

2—200 Amp. Conrad-Schweitzer 3 Pole Fused Load Breaks, 2300 V.

2—150 HP. Westinghouse oil type magnetic contactors, 3/60/2300 V.

1—225 HP. Square D. oil type magnetic contactor, 3/60/2300 V.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y.

CL. 4758

KIEMLE OFFERS

Rebuilt and Sold with a Standard New Guarantee

IND. FREQUENCY CHANGER SETS

MOTOR GENERATOR SETS
ALTERNATORS, ALL FREQUENCIES
TRANSFORMERS, LARGE STOCK
D.C. GENERATORS, ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES
VOLTAGE AND CYCLES

3 ph. 60 cy. A.C. Motors
3 ph. 25 cy. Motors
125 Volts D.C. Motors
230 Volts D.C. Motors
550 Volts D.C. Motors

THE FRED W. KIEMLE CO., 33 N. SUPERIOR ST., TOLEDO 4, OHIO

Put all idle equipment to work. Send your list for prompt action. WRITE OR WIRE YOUR INQUIRIES

POWER PLANT SPECIALISTS

SPECIAL OFFERING

3—1200 HP 600 lb. Pressure Water Tube Boilers oil burning, superheaters, all trim and fittings including soot blowers etc—unused.
2—500 HP Babcock & Wilcox Sectional Steel Header Boiler, superheaters, coal burning.
2—22500 lbs. per hour, 400 lb. pressure Water Tube Boilers, oil fired, superheaters, soot blowers—all trim and fittings.
4—38000 Pounds per hour. Sectional header. Water Tube Boilers—Unused—500# Pressure Complete with Superheaters—Economizers—Oil Burners, Soot Blowers.
1—4000 KW. 400 lb. pressure, condensing turbo generator 3/60/2300/4100 volts.
1—3000 KW. 200 lbs. pressure turbo generator, condensing 3/60/2300 volts.
BOILERS, water tube and portable type, 100 HP up to 2500 HP up to 750 lbs. pressure.

NOTE TO READER

The rapid turnover of our stock has made us feel we cannot publish a complete list of current offerings.

State your needs—We will post you promptly.

Our present stock consist of over 5000 items, in our warehouse consisting of all types of TURBO GENERATORS, SWITCHGEAR, AIR and OIL CIRCUIT BREAKERS, RELAYS of all types, TRANSFORMERS, PUMPS, 800 VALVES—NEW and USED, up to 1500# pressure, and other items used in Industrial and Power Plant Construction.

HOWE BROTHERS

324-328 PEARL ST., NEW YORK 7, N. Y.

Phone—Worth 2-2708—2709—2710

Rebuilt Power Transformers

SINGLE PHASE—OISC

3—2000 KVA GE 13200/26000 to 2300 V.
7—4000 KVA GE 15950/27600 Y to 13,800/6900/4160 Y.
3—667 KVA Packard 23000 to 460/230 V.
6—667 KVA 11000/22000 to 440 V.
3—750 KVA GE 13200/2300 V.
3—2000 KVA Whse. 33000 to 11000 V.
2—400 KVA Al. Ch. 66000/2300/4000 Y.
2—1200 KVA Whse. 66000/2300/4000 Y.
3—333 KVA GE. 11500 to 2300 V.
3—2000 KVA 33000 to 13,200/6600 V.

THREE PHASE

1—3000 KVA GE. 11600 to 440 V.
1—1200 KVA Whse. 6600 Y to 2300 V.
1—15000 KVA Pitts., 27880 to 4560Y. V.

WATER COOLED

4—3333 KVA GE 25/60 cy. 60000 to 4000/6925Y/8000/13850.
3—1500 KVA Al. Ch. 33000 to 13200/6600 V.

PYRANOL

1—3000 KVA Penna. 25 cy. 13,800 to 480 V., 1 ph.
19—37½ KVA Penna. 440 V. to 220 V. 60 cy., 1 ph.
9—100 KVA Penna. 2200/220/110, 60 cy., 1 ph.

NETWORK TRANSFORMERS

19—150 KVA GE, type Ht, late type, oil or pyranol cooled, 3 ph., 60 cy., 27060/125/216Y Mult or submersible type; attached to each transformer is GE automatic heavy duty network protector type MG-6 and heavy duty primary switch; complete with all accessories.
8—200 KVA GE, type Ht, late type, oil or pyranol cooled, 3 ph., 60 cy., 27060/125/216Y Mult or submersible type; attached to each transformer is GE automatic heavy duty network protector type MG-6 and heavy duty primary switch; complete with all accessories.

PHILADELPHIA TRANSFORMER CO.

2829 Cedar St. Phila., Penna.

TRANSFORMERS

3—75 KVA Maloney 60 cy., 1 ph. 13200-260/520
1—250 KVA G.E. 60 cy., 1 ph. 7800-460
1—75 KVA Maloney 460-230/115, 60 cy., 1 ph.
200 Auto Boosters 15 and 25 KVA, 208, 230/240, 3 ph.
136—1 KVA 4400-110/115/120, 60 cy., 1 ph.

New or used. All types and sizes

ATLANTIC TRANSFORMER CO.
TRANSFORMER SPECIALTIES

5143 N. 2nd St. Philadelphia, Pa.

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REWOUND - REBUILT

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IN STOCK

1—600 KVA Westinghouse 3 ph.
1—1000 KVA G.E. single ph.
2—750 KVA Pittsburgh Single ph.

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Zenith Transformer Co.

1733 N. 5th St. Phila. 22, Pa.
Phone 5-0553

NEW BUDA GASOLINE GENERATORS
50 KW. 3/60/240 v. 86 HP, Gas engines
Model M-766, complete, packed.
ALSO
NEW 120 KW. DIESEL POWER PLANT
2—Hercules 75 HP. 6 cyl. engines
2—60 KW. 3/60/240 v. 1200 RPM. Gen.
STEPHEN A. DOUGLASS CO.
630 Fort Washington Ave., New York 33, N. Y.

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

1-75 KW M/G Set

G.E. Factory Built Generator
75V, 1000 Amps.
Motor: 115 HP Type IQ Induction
ELECTRIC APPARATUS REPAIR CO.
1400 N. 6th St. Philadelphia 22, Pa.

Write—Wire—Phone us if you don't see the item you need. This listing is only a part of our of our large stock.

M-G SETS

225 KW G.E. MPC gen. DC 125 V. coupled to 350 HP Whse. synch. motor 3/60/440 V. 900 RPM.
150 KW Gen. Elec. type MPC gen. DC 125 V. coupled to 225 HP sq. cage motor 3/60/2200 V. 1200 RPM.
150 KW G.E. MPC gen. DC 250 V. coupled to 225 HP sq. cage motor 3/60/440 V.
125 KW G.E. DLC gen. DC 250 V. coupled to 150 KVA synch. motor 3/60/440 V.
60 KW G.E. C.D. gen. DC 60 V. 1000 amp. coupled to 90 HP synch. motor 3/60/220/440 V.
40 KW Martin rotary converter, input 3/60/220 v., output DC 230 v., with panel.
37½ KVA Whse. AC gen. 3/60/240 V. coupled to 50 HP Whse. SK motor DC 230 V. 1150 RPM. 3 brg.
Others available—special units built to order.

D. C. MOTORS

H.P.	Mfg.	Type	Volts	Speed
125	Cr. Wheeler	125H	230	500
100	Gen. Elec.	BRC	115	1150
75	Cr. Wheeler	125H	230	350/750
75	Whse.	S136	125	475
75	Gen. Elec.	DLC	230	400
65	G.E. Northern	C	230	375/750
60	Diehl dynamom.	R10	250	500/2000
50	G.E. Sprague	LC	250	700
50	Allis Ch.	E131	230	1150
50	Cr. Wheeler (5)	50H	230	700
40	Roth	S	115	850
35/50	Gen. Elec.	CD123	230	575/1150
25	Gen. Elec.	DLC	115	750
25	Roth	elevator	230	725
25	Whse. enclosed	SK	230	600
20	Cr. Wh. b.b.	EH	230	850
20	Imperial int. dty.	D37	230	1200
20	Gen. Elec.	LC	230	575
20	Gen. Elec.	DLC	230	500/1500

SLIP RING MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts

Qu.	H.P.	Mfg.	Type	Speed
1	400	Gen. Elec. 3 brg.	I-P	450
1	400	Allis Ch. 2200 v.	AFY	1800
1	300	Whse.	HF	400
1	300	Burke	EMV	225
1	200	G.E. 2200 v.	I-M	360
1	200	Whse. 3 brg.	HF	600
1	75	Gen. Elec.	I-M	514
1	75	G.E. 2200 v.	I-M	1800
1	75	F. Morse 2200 v.	BV	1800
1	50	Whse.	NW332	900
1	50	Gen. Elec.	I-M	600
1	50	G.E. 2 phase	I-M	900
1	50	F. Morse b.b.	HV	1200
1	40	Gen. Elec.	M546	514
2	40	Allis Ch.	ANY	450
1	40	G.E. 550 v.	MT536	900
1	37	G.E. int. duty	ITC	600
3	35	Lancashire b.b.	late	1800
1	35	Whse. int. duty	CW	900
2	30	Allis Ch.	ANY	900
1	30	Gen. Elec.	MT326	1200
1	30	Gen. Elec.	MT346	600
1	25	Burke	EMV	1200
1	25	G.E. 2200 v.	I-M	900
1	25	F. Morse b.b.	HV	600
1	25	Gen. Elec.	I-M	600
1	20	Wagner	19TRS	900

SYNCHRONOUS MOTORS

H.P.	Mfg.	Type	Volts	Speed
750	Allis Ch.		220/400	1200
200	Elec. Machy.		220/440	600
150	Elec. Machy. New 8 PF		220/440	360

SPEED REDUCERS & GEAR MOTORS
Many sizes, new and rebuilt in stock for prompt shipment.

CENTRIFUGAL PUMPS
8" Alberger, 2000 gpm @ 80 ft.
6" Platt, 1000 gpm # 230 ft.
8" Worthington, 2000 gpm @ 200 ft.

SQUIRREL CAGE MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
2	165	Gen. Elec. 550 v.	I-K	1800
1	125	Ideal	A	1800
1	60	Ideal	A	1200
1	50	Gen. Elec.	FT523	3600
1	50	Allis Ch.	B	900
2	50	Whse. 2200 v. vert.	CS	900
1	40	Gen. Elec.	I-K	900
6	40	Reliance b.b.	C445	1200
1	40	Allis Ch. 3 spd.	ARX	900/600/450
4	30	Reliance b.b.	C444	1200
1	30	Whse.	CCL	600
1	30	Gen. Elec.	I-K	720
1	25	Gen. Elec.	I-K	600
2	25	Gen. Elec.	I-K	1200
2	25	Allis Ch.	AN	900
2	20	Gen. Elec.	KT312	1200
2	20	Century b.b. 4 spd.	SC504	1800

25 CYCLE MOTORS

H.P.	Mfg.	Type	Speed
450	Whse. 2200 v.	CW sl. rt.	750
150	Whse.	ED sl. rg.	500
100	Whse.	CCL sq. cg.	500
75	Gen. Elec.	I sq. cg.	750
50	Allis Ch.	ANY sl. rg.	1500

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Gen. Elec. 1	MFC	125/170	1150
100	Fair Morse	TR	250	800
75	Whse.	S	125	600
60	Gen. Elec.	DLC	250	450
50	Cr. Wheeler	CCD	250	850
30	Lincoln b.b. 600 amp.		50	1200
25	Whse.	S	125	1200
25	Gen. Elec.	DLC	125	900
25	Cr. Wheeler b.b.	CCD	125	1800
20	Allis Ch. (2)		125	475

SPECIAL — 3 — Oil Gear Co. Pumps, 1100 lbs. 104 gpm., on steel base — BARGAIN.

60 CYCLE A.C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
750	Allis Ch.		440	1200
400	G.E. 3 brg.	ATB	2300	514
300	G.E. 3 brg.	ATB	2300	450
200	Gen. Elec.	ATB	2300	600
165	Elec. Machy.	BRKT	240/480	900
150	Allis Ch. 25 cycle		240/480	500
125	Allis Ch.	B	240/480	900

ARTHUR WAGNER COMPANY

1436-38 W. RANDOLPH STREET — CHICAGO 7, ILL. — MONroe 7409

DIESEL ENGINES FOR SALE

1—60 HP Chicago Pneumatic, horizontal, semi.

1—75 HP F-M full diesel.

2—100 HP F-M, 2 cylinder, vertical, semi.

1—200 HP Worthington, 4 cylinder, full diesel.

Several with A.C. Generators, 240/480 volts.

We buy and sell all types of Pumps, Compressors, Boilers, Processing Equipment and Conveyors.

LOU COHEN PUMP & MACHINERY CO.

715 Howard Street — St. Louis 6, Missouri

Telephone: GArfield 4290

Electrical Equipment

C. B. LOCKE CO.
P. O. BOX 3227
TEL. 38-136
CHARLESTON, W. VA.

NEW and REBUILT

We build SUB-STATION equipment to fit your requirements. Highest quality A. C. and D. C. Motors, Control Equipment and Transformers.

MOTORS

1—80 HP. 1200 RPM, CR. WH. 220/440/3/60 Ind.
1—75 HP. 1800 RPM U.S. Line Start 220/440/3/60 Ind. B.B.
1—65 HP. 1200 RPM. GE Type KT 220/440/3/60 Ind.
1—65 HP. 1200 RPM GE Type KT 440/3/60 Ind.
1—40 HP. 900 RPM. Whse. Type CW 440/3/60 Sl. Ring
5—5 HP. 2200 RPM Reliance, Ex. Proof, 230 V. DC.
1—Lot Whse. Type SK. 230 V. DC.
Other AC & DC Motors in Stock.
Cross Line & Reduced Voltage Starters.

TRANSFORMERS

1—200 KVA Kuhlman, Cont. Duty, Auto, 3800-2300/3/60
3—37½ KVA Pitts, Cont. Duty, Auto, 6900-2300/1/60
A few others in stock.

MOTOR GENERATOR SETS

1—150 KW Ridgeway, 900 RPM, 250 V. D.C. to 225 HP. 2300 volt Syn. complete with control equipment.

SYNCHRONOUS ROTARY CONVERTERS

6 phase 60 cycle

Qu.	KW	Make	Speed	D.C.V.	Trans. V.
1	1500	Whse.	450	250	2300/4160
2	500	Whse.	1200	600	#
2	300	Whse.	1200	275	#
3	300	Whse.	1200	600	#
3	150	Whse.	1200	275	#

Transformers, your spec. 3 to 6 months

TURBO ALTERNATORS

Complete with Auxiliaries and Control Equipment
1—3650 KVA 3600 RPM, 2300/3/60, Whse
1—3125 KVA, 3600 RPM, 2300/3/60, Whse

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt St. New York, N. Y.

A. C. TURBO UNITS

750 KVA GE 2300 v; 250#
750 KVA GE 480/240 v., Cond.
625 KVA Whse. 480 v., 250# (Bleeder)
625 KVA Elliott 480 v. (Non-Cond.)
375 KVA GE 2300 v. (Cond.)
250 KVA (2) GE 480/240 v. (Non-Cond.)
125 KVA CW 220 v.-Moore (Non-Cond.)
115 KVA GE 480/220 v. (Non-Cond.)
110 KVA Al. Chal.-Elliott 220 v. (Non-Cond.)

DIESEL UNITS

Fairbanks Morse
700 KVA, 600 KVA, 250 KVA, 65 KVA, 40 KVA

Cooper Bessemer—300 KW CW 250 v. dir. current.
Worthington
225 KVA, 125 KVA, 90 KVA
Catapillar
75 KVA GE, 62½ KVA GE
Winton-GE (2) 118 KVA 240/480 v.—400 RPM

STEAM ENGINE UNITS (A. C.)

400 KVA GE-Nordberg Uniflow
350 KVA GE-Ames Unif.
187 KVA Wghse.-AMES Unif. Vertical
187 KVA GE-Chuse 4 v.
79 KVA Al. Chal.-Ames Unif.

STEAM ENGINE UNITS (D. C.)

200 KW (2) 250 v. 3 wire-Ames Unif; Vertical

MISCELLANEOUS

500 H.P. (4) Sterling 200#
Surface CONDENSER—4100 sq. ft.
TRANSFORMRS 3—333 KVA GE 2400-240/120 v.
327 HP Stirling; 3 Welded Drums.
3—125 KVA Wghse. 22000-440/220/110 v.
300 KVA and 150 KVA GE 3 ph. 33,000/66,000-2300/4000 v.

SEARCHLIGHT SECTION

BOILERS

6—30,000# Foster Wheeler 475# pressure boilers with oil burners, 1942.
1—519 HP Titusville, 3 drum, low head, 200#, underfeed stoker, new 1935.
3—768 HP Stirling Boilers, 200# pressure.
1—650 HP Casey Hedges, 225#, new in 1930.
2—500 HP Scotch Marine Boilers, 200# with oil burners.
1—40 HP Leffel Scotch Marine boiler, 125#.
5—500 HP Stirling Boilers, 200#, ASME.

TURBINES

1—6250 KW General Electric 1800 RPM, Condensing, all auxiliaries.
1—750 KW.3-60-240 volt General Electric Automatic Extraction.
1—3700 KVA General Electric Condensing Turbine.
1—150 KW. 3-60-240 volt General Electric Non-condensing, new in 1942.

DIESEL ENGINES

3—300 KVA Fairbanks-Morse Full Diesel Engines.
3—200 KVA Fairbanks-Morse Full Diesel Engines.
2—400 KW McIntosh-Seymour, 3-60-2300 volts, all auxiliaries.
2—300 KW General Motors Portable Diesel Engines, 3-60-480 volts.
1—575 KVA Rathbun-Jones, 300 RPM, 3-60-480 volts, brand new.

ENGINE GENERATOR SETS

1—27"x36" Skinner Uniflow, direct connected to 562 KVA AC Generator, complete.
1—565 KVA Skinner Uniflow Engine Generator.
1—375 KVA Harrisburg Uniflow Engine.
1—28"x36" Hamilton Uniflow direct connected to 750 KW, 3-60-2300 volts, all auxiliaries.
1—600 KW Skinner Vertical D.C. Generator.
1—600 KW Non Releasing Corliss, 3-60-240 volts.

MISCELLANEOUS

300 HP Kerr, 3600 Non Condensing Turbine.
2500 HP Cochrane Open Feed Water Heater.
1—10' x 15' Illinois Forced Draft Chain Grate Stoker.
1—300 GPM Pennsylvania Boiler Feed Pump, motor driven.
3—Type E Under Feed Stokers, 600 HP.
2—150 HP Canton Ram-fed Stokers.
2—75 HP Elliott Geared 900 rpm turbines 385# steam pressure.
1—232 GPM Centrifugal Boiler Feed Pump, turbine Driven, 1200 ft. head.

SEE Fletcher FIRST!

FLETCHER SALES CO.
325 Fincastle Building — LOUISVILLE, KY.

ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

SLIP RING MOTORS
3 Phase—60 Cycle

Qn.	HP	Volts	Speed	Make	Type
2	40	2200	865	Al.-Ch.	ARY-223C
5	52	220*	550	G.E.	IQC-5013***
1	60	2200	1200	G.E.	MT-B-343
1	60	550	570	G.E.	MTC-5546
1	75	550	720	G.E.	MT-556
1	75	220*	1750	West.	CI-653 C
1	80	440*	575	G.E.	MTC-5352
1	100	220*	1760	Al.-Ch.	ARY-223BS
2	125	440*	430	G.E.	IL-16
1	150	550	385	G.E.	IM-17
1	150	2300	490	West.	CW-956A
2	200	550	600	G.E.	IM-17
3	250**	220/380	296	West.	CW-20-53-15
2	300	550	514	G.E.	IM-17A
1	400	550	505	West.	CW

* Can be furnished either 220 or 440 volts, but not both voltages.
** 50 Cycle (New). *** 2 Phase.

ADJUSTABLE SPEED D.C. MOTORS

6—40/50 HP. 400/1600 RPM, 230 volt, Cont., Shunt Wound, Reliance and Allis-Chalmers, Ball Bearing. Adjustable Speed D.C. Motors Complete with Non-reversing Dynamic Braking Controllers.

NEW DC MOTORS

22—Allis-Chalmers 10 HP, 1200 R.P.M., 230 Volt, D.C., EB-80, Dripproof, 40°, B.B.
20—West., 12.5 HP, 600 R.P.M., 230 volt D.C., Marine SK-93, Tot. Encl. B.B., ½ Hr. 55°.

SQUIRREL CAGE MOTORS
3 Phase—60 Cycle

Qn.	HP	Volts	Speed	Make	Type
1	25	2200	1140	West.	CCL
1	30	220*	870	West.	CS-646
2	30	440*	1160	West.	CS-644
1	50	2200	900	G.E.	KT-346
1	50	220*	850	West.	CCL
1	75	2200	1750	West.	CS-76
1	100	2200	495	Al.-Ch.	AN
1	100	2200	580	G.E.	IK-15
2	100	2200	500	West.	CS-930-TEFC
1	150	440*	580	West.	CCL
5	150	440*	1800	Howell	N-684
5	200	550#	580	G.E.	KT-656S
1	200**	500	2950	West.	CS-8120-TEFC

* Can be furnished either 220 or 440 volts, but not both voltages. ** 50 Cycle (New).
# Reconnectable for 440 volts.

NEW DC MOTORS

5—General Electric, 50 HP 525 RPM, 230 volt D.C., Compound Wound, Marine Type COM-1830-AE, Model 27B124, Totally Enclosed, Ball Bearing, ½ Hr. 55°.
2—General Electric, 60 HP, 550 RPM, 230 Volt D.C., Shunt Wound, Marine Type COM-1831-AE, Model 28B84, Totally Enclosed, Ball Bearing. ½ Hr. 55°.

NEW A.C. GENERATORS

18—Leland, 2.5 KVA, 120 Volt, 1800 RPM, 60 cycle, Single Phase, Type AG, Frame 50, Form BOWJH, Continuous, Self-Excited.

The Above Listings Are Representative of Items Available for Prompt Shipment from Our Cleveland Warehouse. We Also Have a Large Stock of Synchronous Motors, Constant and Adjustable Speed DC Motors, Rotary Converters, Circuit Breakers and Control Equipment.

ELECTRIC GENERATOR & MOTOR CO.
4521 HAMILTON AVE. — CLEVELAND 14, OHIO

PUMPS

Rebuilt & Guaranteed

PUMPS—Large stock centrifugal—turbine—piston.

STEAM PUMPS—Duplex - Simplex. Reconditioned and guaranteed.

BOILERS—stacks—Engine Generators—condensers.

LOU COHEN
PUMP & MACHINERY COMPANY
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FOR SALE BY OWNER

2—Ames Vertical Steam Engines, rated 320 HP, 400 RPM with 165 pressure. Each Engine directly connected to Electric Machinery Company 250 KVA, 200 KW, 601 ampere 80% P.F. 240 volt generator with panels complete on the foundations. Write

FS-231, Power
520 North Michigan Ave., Chicago 11, Ill.

PUMPS, Motor & Steam Driven

G.P.M.	Head	Make	Type
6000	33'	LeCourtenay	Centrif.
1100	220'	Allis-Chalmers	Centrif.
1000	280'	Diesel Driven	Centrif.
1500	100'	Lawrence	Centrif.
1500	200'	Westinghouse	Centrif.
1100	110'	Westinghouse	Centrif.
700	250'	Worthington	Centrif.
400	350'	Goulds	Triplex
175	350	Goulds	Triplex
500	175'	Blackmer	Rotary
450	700'	Worthington	Rotary
450	231'	Kinney	Rotary
300	150'	Viking	Rotary
1000	460'	Knowles Fire Und.	Steam
800	350'	Blake-Knowles	Steam
750	460'	Snow Fire Und.	Steam
600	350'	Snow	Steam
500	350'	Foster	Steam
300	231'	Gardner	Plunger

Also large selection of various capacities.

M. G. & STEAM DR. SETS

K.W.	Make	Volts	Type
25	Green Eng.	220 D.w.	Belt Drive
2	Gasoline Eng.	120 A.C.	Dir. Drive
6½	Gasoline Eng.	120 A.C.	Dir. Drive
17	Sturt Turbine	110 D.C.	Direct Drive
7½	Sturt Turbine	110 D.C.	Direct Drive

D. C. MOTORS ALL SIZES

100	Northwest	220	1750
25	Roth	230	1750
10	Crock. Wheel.	110	925
10	Weschge	110	1700
1½ to 7½	H.P.	All Makes	
40	Electromotor	230	340

CONDENSATION RETURN UNITS

Nash-Jenn Dump. Vac. Heat. 26000EDR
Nash-Jenn Simp. Vac. Heat. 1600EDR
Condensation Units, 100 to 250,000 EDR

AIR COMPRESSORS

C.F.M.	Pressure	Make	Type
850	100	Laidlaw	Hor. dup.
150	20	Westinghouse	Steam
400	125	American	Horiz.
350	40	Worthing	Horiz.
140	125	Curtis	Vert. Dup.
28	5000	Norwalk	4-Stage

TURBO-CENTRIFUGAL BLOWERS

2500	28 oz.	Buffalo	Motor dr.
1300	16 Oz.	North American	Motor dr.
1100	16 oz.	Fisher	Motor dr.
2500	32 oz.	Buffalo	Motor dr.
420	56 oz.	Spencer	Motor dr.
400	16 oz.	Spencer	Motor dr,
250	16 oz.	Spencer	Motor dr,
50	16 oz.	Allen-Billmyre	Belt dr.

BLOWERS & EXHAUSTERS

C.F.M.		St. Pres.	Make	Type
100	60000	½"-5"	Buffalo	Various
100	15000	½"-16 oz.	American	Various

ROTARY PRESSURE BLOWERS

C.F.M.	Press	Make	Type
4000	3 lbs.	Roots	Belt dr.
3000	3 lbs.	Roots	Belt dr.
2000	3 lbs.	Sturt.	Belt dr.
1000	3 lbs.	Roots	Belt dr.
500	3 lbs.	Roots	Belt dr.
235	1 lb.	Fuller	Direct dr.
110	15 lbs.	Beach R	Belt dr.

VACUUM PUMPS

1000	15 in.	Roots	Belt dr.
350	27 in.	Worth	Belt dr.
100	high vac.	Beach R	Gear dr.
100	27 in.	Deane	Belt dr.
100	29 in.	Devine	Belt dr.
100	20 in.	Nash	Direct dr.

MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
150	West.	440	700	CS
100	Lincoln	220	1750	
50	G. E.	2300	1750	I
50	West.	220	850	CCL
50	West.	220	570	CS
30	Burke	220	1150	342
40	G. E.	220	870	Slprg.
30	Wagner	220	850	Slprg.

Also 10 to 30 H.P. in All Makes

SIMILAR EQUIPMENT IN STANDARD MAKES AND SMALLER SIZES
HIGHEST PRICES PAID FOR YOUR IDLE EQUIPMENT

SUPERIOR EQUIPMENT CO.
138 Grand St., N. Y. C. Tel. CAnal 6-6983-4

STEAM ENGINES

Turb. Cent. Bronze Pumps
Steam Pumps—All sizes
10"x10" Greenfield Vertical
7"x7" Wickes Bros. Vertical
6"x6" Vertical & Smaller
1 to 40 H.P. Steam Turbines

SLIP RING MOTORS

3-PH., 60 Cy.

HP	Volts	Make	Speed
900	2300	G.E.	900
600	2200	G.E.	720
500	2300	G.E.	900
300	440	Al. Chal.	900
250	2300	G.E.	600
350	440/550	G.E.	600
200	2200/440	G.E.	600
150	2200	G.E.	450
150	2200/440	G.E.	600
150	440/220	G.E.	1200
125	440/220	Whse.	1200
125	440/220	G.E.	1200
125	440/220	G.E. (Hoist)	900
100	440/220	G.E. MTC	900
100	440/220	Whse.	1200
100	440/220	G.E.	1200
80	440/220	G.E. (MTC)	900
75	2200	Al. Chal. (new)	900
75	440/220	G.E. (MTC)	600
75	2200/440	G.E.	1200
50	2200/440	G.E.	600
75	550	G.E.	900
40	2200	Whse.	900

OUTDOOR OIL CIRCUIT BREAKERS

1—New 400 Amp. Type FK, 136-132 General Electric, 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's PT's, etc.

1—New 25500 amp., DA 75, Whse., 3 pole, air type circuit breaker

SYNCHRONOUS MOTORS

3-PH., 60 Cy.

500	440/220 v.,	G.E.	TS	900
475	4000/2300 v.	Cr. Wh.		900
300	440/220	G.E.	ATI	600
300	4150/2300	Cr. Wh.	SYN	900
300	2200	Whse.	G	720
300	440/220	Al. Ch.		600
250	4000/2300	G.E.	TS	1200
240	2200	G.E.	ATI	600
200	4150/2300	Whse.	G	1800
200	2200	G.E.	ATI	514
150	4150/2300	G	G	1800
110	440/220	G.E.	TS	1800
100	440/220 25 cy.	G.E.	TS	375

A. C. GENERATORS

1—450 kva., 900 rpm., 440/220 v., GE.
1—450 kva., 900 rpm., 4000/2300 v., Cr. Wh.
1—300 kva., 900 rpm., 4000/2300 v., Cr. Wh.
1—300 kva., 600 rpm., 440/220 v., G.E.
1—225 kva., 600 rpm., 440/220 v., G.E.
1—190 kva., 514 rpm., 220/440 v., G.E.
1—150 kva., 900 rpm., 440/220 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
1— 36 kva., 360 rpm., 480/240 v., G.E.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G	K	1200
500	440/220	G.E.	IK	900
400	2200/440	Whse.	CS	720
400	2220/440	G.E.		600
400	550	G.E.	IK	720
350	440	G.E.	IK	900
200	440/220	Whse.		1200
220	2200	G.E.		1800
200	440/220	Wagner	RP	1800
200	2200/550	Al. Ch.	AR	900
150	2200/550	Al. Ch.	AR	1800
150(3)	440/220	G.E.	KT	1200
125	2200	G.E.	KT	600
100	440	G.E.	IK	450
100	2200	G.E.	KT	1800
100	440	Whse.	CS	1200
74	2200	G.E.	KT	900
50	2200	Al. Ch.		720

MOTOR GENERATOR SETS

1—150 kw., 250 v., 1200 rpm., GE, conn. to 225 hp. 2300/440 v., 60 cy., synchronous motor.
1—100 kw., 250 v., 900 rpm. Whse., conn. to 150 hp. 2300 v., 60 cy., sq. cage motor.
1—60 kw., 250 v., 1200 rpm. G. E., conn. to 90 hp. 440/200 v., 60 cy., syn. motor.
1—60 kw. 125 v., 1200 rpm. Whse., conn. to 75 hp. 440/220 v., 60 cy., syn. motor.
1—35 kw., 120 v., 1800 rpm. G.E., conn. to 50 hp. 440/220 v., 60 cy., squirrel cage.

TRANSFORMERS

60 Cycle

3—333 kva., Whse., 13200-2400 v.
2—333 kva., Moloney, 13800/6900-230/460 v.
1—300 kva., Whse., 3 Ph., 13800-230 V.
3—250 kva., Whse., 13,800-460.
3—200 kva., Ptsb., 13200/6600-460 v.
3—100 kva., G.E., type H 2400-240-480.
3—100 kva., G.E., type H-KDD, 6900/11950V-230.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

SYNCH. CONVERTERS

500 KW G. E. 250 D.C. 2300 /4000 A.C. 1200 RPM, 6 PH, 60 CY.

500 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM, 6 PH, 60 CY.

300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM, 6 PH, 60 CY.

MOTOR GENERATORS

150 KW G.E. SYN. 250 V. 2300 A.C. 900 RPM, 3 PH, 60 CY.

150 KW G.E. SYN. 600 V. 2300/4000 A.C. 1200 RPM, 3 PH, 60 CY.

Each unit listed above is owned by us and is available now for immediate purchase

WALLACE E. KIRK CO.

Incorporated

502 Grant Building, Pittsburgh, Pa.

GASOLINE POWER UNITS

1— 90 HP Waukesha, JS18B, 5½x7, 900 RPM
1—110 HP Waukesha, WL-34, 6¼x8, 900 RPM
1—125 HP Wisconsin, E, 6x7, 900 RPM
3—135 HP Bud's, JL1335, 6¼x7¼, 1250 RPM up
1—225 HP LeRoi, RX18V, 6-3/4x7, 1250 RPM up

GENERAL MACHINERY & EQUIPMENT CO., INC.
809 Woodland—Kansas City 6, Mo.
Telephone Victor 0018

POWER EQUIPMENT

1—150 K. W. 125 volts 400 RPM Crocker-Wheeler compd wound interpole Generator to a 4 cylinder, vertical unaflow Ames engine.
1—360 HP Anderson full diesel, Model 2° 257 RPM with clutch and pulley on one end to drive an ice machine or any other machine and a 125 KVA, 3 phase, 60 cycle, 240 volt Generator direct connected on opposite end.
1—90 KVA, 3 ph., 60 cy., 2300 V, Fairbanks Morse Generator connected to a 2 cylinder Fairbanks Morse full diesel type Y, style VA.
1—156 KVA., 3 ph., 60 cy., 240 volt, 1200 RPM, type ATB frame 9635 General Electric connected to an 8 cylinder Buffalo Gasoline engine.
1—1000 K.W. 3 ph., 60 cy., 480 volt, 3600 RPM, General Electric Generator to a General Electric turbine 190 lbs steam pressure 40 lbs back pressure.
1—500 KW, 3 ph., 60 cy., 2300 vlt. 3600 RPM General Electric non-condensing Turbo Generator.
1—300 KW, 3 ph., 60 cy., 440 vlt. 3600 RPM Westinghouse Generator only.
7—500 amp. 6 V direct current to 3 ph., 60 cy., 220 vlt. General Electric rectifiers.
1—750 KW Gen. Elec. Extraction type Turbine 3 ph., 60 cy., 600 vlt. 150-175 lbs., 10 to 20 lbs. extraction.
1—100 KW, 125 V, type CD1247 General Electric to a 150 HP 3 ph., 60 cy., 220 vlt. type K5572 Gen. Elec. induction motor.
1—125 KW, 125 V, type CD1348 General Electric to a 3 ph., 60 cy., 220 V, type TS9647 General Electric syn. motor.
1—50 KW, 250 volt Gen. Elec. to a 75 HP 3 phase, 60 cycle, 440 Vlt. General Electric motor.
A large number of new 115 volt direct current ball bearing General Electric motors 5 to 20 HP.
1—1500 KW, 250 vlt., 600 RPM Westinghouse rotary converter complete with transformers and switchboard.

Send us your inquiries, our stock is continually changing.

KEYSTONE
Power Plant Equipment Company
8403 Hegerman St. Phila. 36, Penna.

NEW—MOTORS—REBUILT

18— ½ H.P. G.E. 3/60/110/1800 R.P.M.
10— 5 H.P. G.E. 3/60/220/3600 R.P.M.
4—1½ H.P. C.W. 3/60/220/440/1800 R.P.M.
8— 3 H.P. West. 3/60/220/440/1200 R.P.M.
3— 15 H.P. West. 3/60/220/1800 R.P.M.
5— 15 H.P. G.E. 3/25/220/440/750 R.P.M.
4— 20 H.P. West. 3/25/220/440/750 R.P.M.

FOR SALE

FREQUENCY CHANGERS

8— 3 H.P. G.E. 3/25/220/440/1500 R.P.M.
25—5 H.P. G.E. 3/25/220/440/1500 R.P.M.
25 to 60 Cycle Frequency Changer. 120 KVA.
12—400 Ampere Lincoln Welders 3/60/220/440.
2—2 Ton Watson D.C. Hoist, 230 Volt.
1—667 KVA. General Elec. Transformer, 6600/1143/0Y to 440 V. Sld 2920, 60 Cycle, 1 Ph.

VOLLAND ELECTRIC EQUIPMENT CO., INC.
1511 NIAGARA ST. Phone Grant 2715 BUFFALO 13, N. Y.

BENJAMIN

NEW • ELECTRIC • STEAM • AIR EQUIPMENT
Thousands of Items A/C or D/C from 1 to 500 K.W.

WIRE, MAIL, or PHONE Your Requirements

USED EQUIPMENT Thoroughly Overhauled, Tested & Approved AND GUARANTEED for 1 full year

Agents for Most Popular Make of Motors

Benjamin's RELYABILT EQUIPMENT

Benjamin's for Motors

ESTABLISHED 1904

130 CLINTON STREET ★ BROOKLYN, N. Y. Windsor 5-1700

Thousands of Items - A/C or D/C. From 1 to 500 KW

OVERHEAD CRANES

1-Ton Shepard 12' Span
Detroit 38' Span
2-Ton Conco 27'6⅜" Span
Louden 19'2" Span
Shaw 16'3" Span
Conco 12' Span
3-Ton Shaw 33' Span
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Shepard Niles 27'7½" Span
Morgan 55'6" Span
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P&H 87'6" Span
Niles 75'½" Span
Alliance 100' Span
12½-Ton Niles 75'1" Span
15-Ton Euclid 84'3" Span
Morgan 73'5½" Span
P&H 32' Span
P&H 52' Span
Morgan 82' Span
Whiting 71'10½" Span
Bedford 34'6" Span
20-Ton Morgan 62' Span
25-Ton Bedford 27'3" Span
Bedford 67'8" Span
Shaw 58' Span
Tysaman 60' Span
Shaw 60' Span
30-Ton Ederer 60' Span
Ederer 40' Span
Ederer 76' Span
Niles 57'6" Span
Northern 75' Span
35-Ton Northern 22' Span
40-Ton Shepard Niles 49' Span
50-Ton Cleveland 71'10½" Span
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P&H 32' Span
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75 HP. 900 RPM. 3/60/223 V. General Electric.

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50 KW. 1200 RPM. 3/60/220 V. Allis Chalmers
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42 KW. 250 volt DC 300 RPM. Gen. Elec. gen. dir. con. 10x11 Chuse slide valve engine

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750 GPM., 100 lbs. pressure Allis Chalmers dir. con. 100 HP. 3/60/2300 V. synchronous motor

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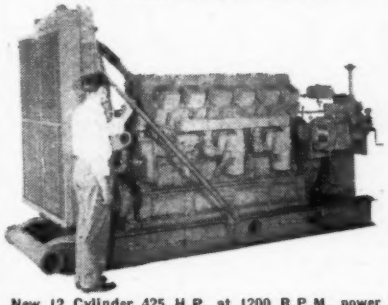

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PUT ALL IDLE EQUIPMENT TO WORK. SEND YOUR LIST FOR PROMPT ACTION

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Fairbanks Morse Equipment

Consisting of:

One—720 HP style M, model 33, 5 cylinder, 16" bore, 20" stroke, 257 rpm, solid injection, 2 cycle, full diesel engine. Direct connected Fairbanks Morse 580 KVA 3 phase, 60 cycles, 2400 volt, frame 651 generator. Direct connected 15 KW exciter.

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Plant complete with all auxiliaries, pumps, coolers, oil filters, switchboards and controls, piping and accessories.

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Motors available, all sizes, ¼ HP to 20 HP, 1140 RPM, 3 Phase, 220 VOLT, 60 Cycle.

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NEW STEEL TANKS

30—10,000 Gal. Cap. Horizontal.
250—4,200 Gal. Cap. Vertical.
7—42,000 Gal. Cap. Vertical.
3—5,000 & 10,000 Bbl. Cap. Vertical.

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1500 KW. COMPLETE POWER PLANT, 10,000 Sq. Ft. Surface Condenser, 600 KW. SKINNER UNIV. UNAFLOW, AC, 750 KW. 6300 KW. Non Condensing Turbo Generator units, 200# & 100# b.pr. DIESEL SETS; 175 KW. 200 KW. 240 KW.

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1—750 hp Hamilton Corliss high speed cross compound rolling mill type engine complete with rope drive, tension carriage tracks, pumps gauge board with instruments.

1—330 hp Heinie water tube boiler, 188 tubes complete with regular fittings, fixtures and stack. Also steel H supports front and rear cross beams and U bolts for boiler suspension.

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1—600 HP WESTINGHOUSE Synchronous Motor, 600 rpm, 2300 volt, 3 phase, 60 cycle, .8 P.F. serial #2S23P722, Frame #12-51-11, Dwg. 12-B-8808, with class 14-250 magnetic full voltage starter, style 3320ISTX. Built 1944. Excellent condition. Used only few months. Unsuited to owner's present voltage.
1—Motor-Generator Set; generator—Westinghouse style 1266482B, 7.5 KW, 125 volt; motor—Westinghouse 15 HP, 1750 rpm, 3-60-220/440 style S.C. with field rheostat 943757. In excellent condition.
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Pipe, 1" to 10", New. Black and Galvanized.
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Underfeed, single retort 1st class condition

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6—15 KW International Harvester, 60 cycle operation, Model UD, Electric starting, radiator cooled engine, for 3 phase, 60 cycle operation at 1200 RPM, 127/220 volts: 12.5 KW, 50 cycle, 230/440 volt. All enclosed, skid mounted, complete instrument panel for generator and engine, automatic voltage regulator, spare parts and tools. Net weight, 3460 lbs.

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Smaller Boilers and Fire Tube Boilers also

Several 425# and 550# Turbo-Generators available
20,000 K.W. GE Co. turbo-generators condensers
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Several 500 KWs. & Smaller Units.

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Slow speed, 60 cycle, 3 phase, any voltage.

300 KW, 300, 327, 360 RPM	600 KW, 720, 900 RPM
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500 KW, 300, 327 RPM	1500 KW, 257, 300 RPM

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1000 KW, 230 volts, 720 RPM

We are prepared to place immediate orders for suitable equipment.

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2—300 H.P. Boilers with stokers in exchange for

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From 750 to 1500 kva, 3 Phase, 13,800 volts to 2,400 volts. Three single phase transformers to given equivalent capacity acceptable.

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There are 4 Franklin water tube boilers of 210 H.P. nominal, set up in a 4 battery brick wall setting with castings, trimmings, stop and check, stop valve and blow offs, approved for 125 lbs. p.s.i. working pressure. Two of these boilers are stoker fired.

They are offered as separate units, one or more, as is in position, the bidder being required to remove the brick work and debris complete for the unit or units bid on deposited on the premises where directed.

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There are 2 Detroit Unistokers grate section 7'-0" wide by 6'-6" long for a 7'-0" setting including a 7½ H.P. D.C. 220 volt motor and lower fronts.

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A bond will be required to insure the removal of the equipment purchase, the amount equal to purchase price.

The bidder shall state the time required for the removal of equipment.

For any further information required, the bidders should contact the Owners, The Order of St. Benedict, Inc., Collegeville, Minnesota, or Toltz, King and Day, Inc., 1509 Pioneer Building, St. Paul 1, Minnesota.

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200 or 250 H.P. Steam Boiler built in accordance with the ASME code laws and will pass inspection in North Carolina. Prefer 250 H.P. but would consider 200 H.T. or H.R.T. Boiler.

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Two D.C. MOTORS

TYPE MPC, CLASS 6—150 H.P. 500. Form A, 500 R.P.M. 250 Volts, General Electric—150 H.P.

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One Used 50 HP. 115 Volt D.C. Motor, compound wound, 1200 R.P.M. G.E., Westinghouse or Allis Chalmers preferred. Reply

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WANTED TO BUY
(for operating 2 air compressors)

2—350 or 400 HP, 600 rpm, 3 phase, 60 cycle, 550 volt synchronous .8 or 1.0 P.F. or
2—300-350 HP, 600 rpm, 3-60-550 induction motors with full voltage magnetic starters.

***Purchasing Dept.*—HOOD RUBBER CO.**
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3 A.S.M.E. WATER TUBE BOILERS

400 horsepower each, designed pressure 200 psi, maximum age 10 years.

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Pacific C-60 low pressure. 15 lbs. steam, 30 lbs. water. Heating surface, 1316 ft., complete with chain grate; ¾ HP motor and hopper. Removed from our line to make way for larger unit. *Contact M. F. Tanzer,*

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1000, 1200 KW, 3 phase, 60 cycle, 2300 volts. 1, 2 or 3 units.

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New Link Belt 225 H.P. Type SW-12, Ratio 1-3.67. Agma service factor 1.

Seven Available, Very Reasonable

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Ask for Mr. Armino

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Type C.E.—Class 4—10 H.P.—650
No. 80413—Spec. No. —
Form B—Speed 650—Volts 230 D.C.
Open—H.P. 10—Amp. 37.5
Closed—H.P. 5.5—Amp. 21.5

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Motor is in excellent condition and ready for immediate use.

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Hotel converting to A.C. will sell 75 Kw. Direct Current Crocker Wheeler D.C. generator type CCD 125 v. 275 RPM—125# pressure: 100 Kw. same type, size 109-D 125 volts 250 RPM Equipped with panel boards; also two—10x14x16—ten inch stem vacuum pumps and one—16x14x16 fresh water house pump made by the Union Steam Pump Co. Equipment to be sold on foundation.

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Atlantic City, N. J.
Phone—A. C. 4-1161
Attn. C. Henry Landow, Gen. Mgr.

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COMPLETE 300 H.P. BOILER PLANT

2—H.R.T. 150 H.P. each—150# working pressure A.S.M.E. code; Diam. shell 72"; length of shell 18'-0"; each with 70-4", 10 gage tubes; plate 17/32"—heads 9/16", battery setting; suspended from fallows frames; built new 1925; insured with Hartford; recent inspection report.

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All piping, valves, pressure reducing valves and other auxiliary equipment complete.

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MARION, INDIANA
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6—D.C. Generators, G.E. 50 KW, 1200 RPM, 125/125 V., compound wound, 50°C.

50—A.C. Generators, G.E., 15 KW, 18.75 KVA, 120/240 V.—3 wire, one phase, 60 cycle, 1200 RPM, with top mounted exciter.

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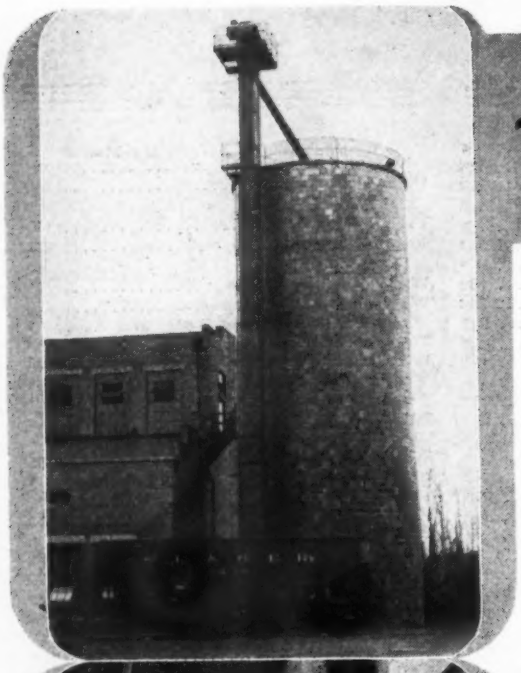

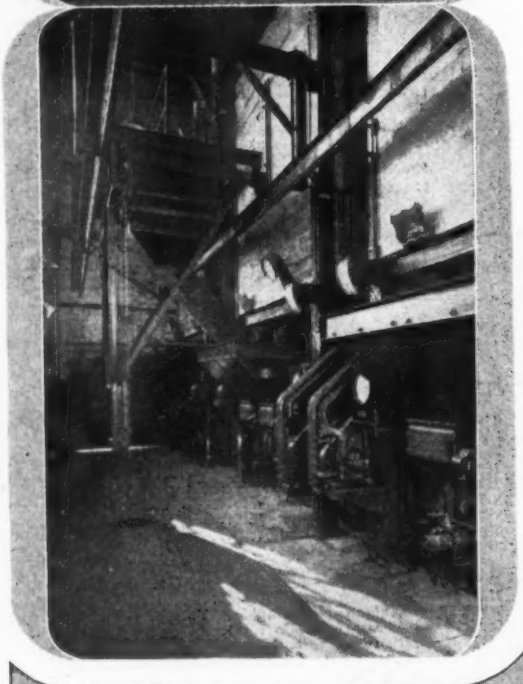

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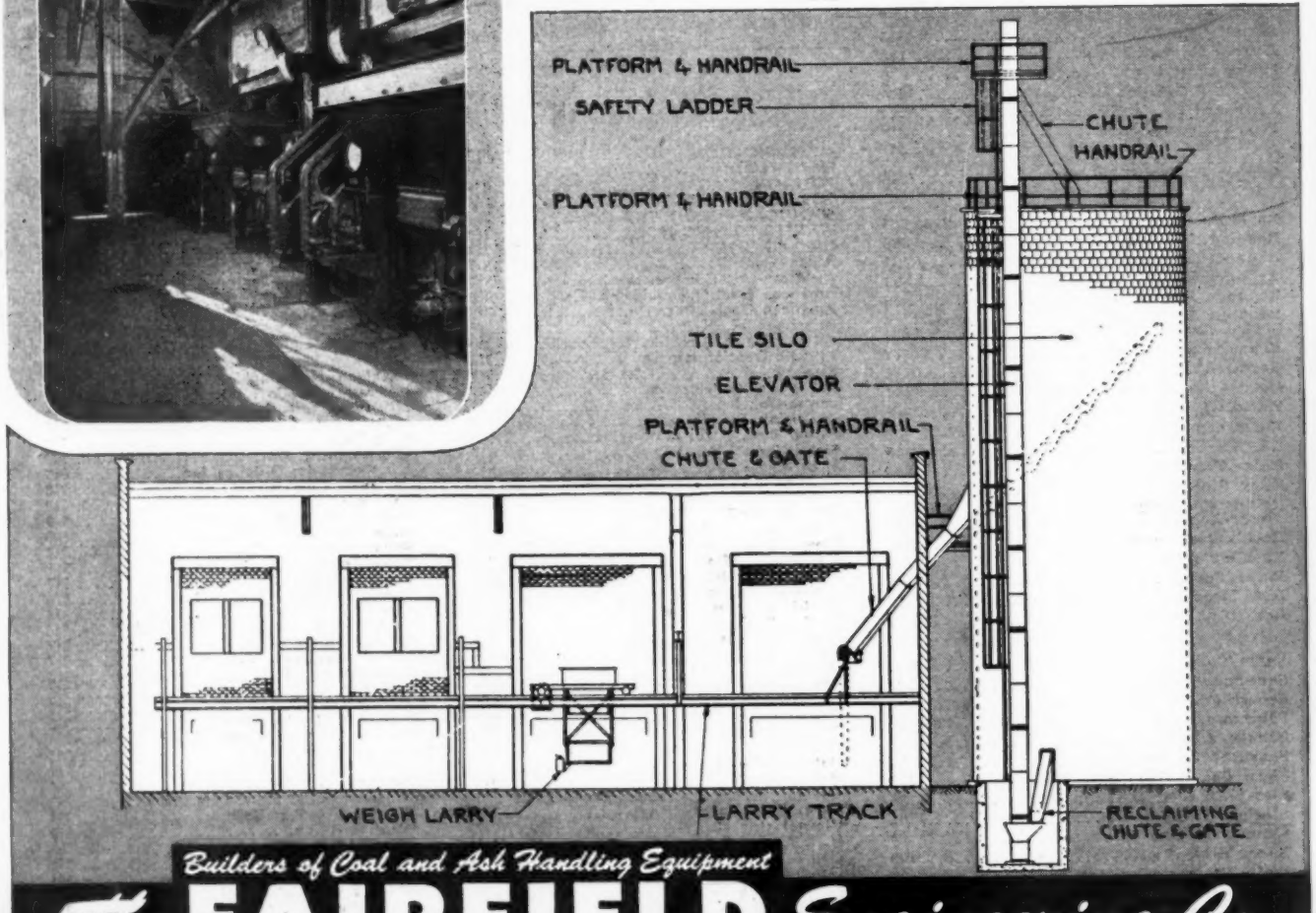

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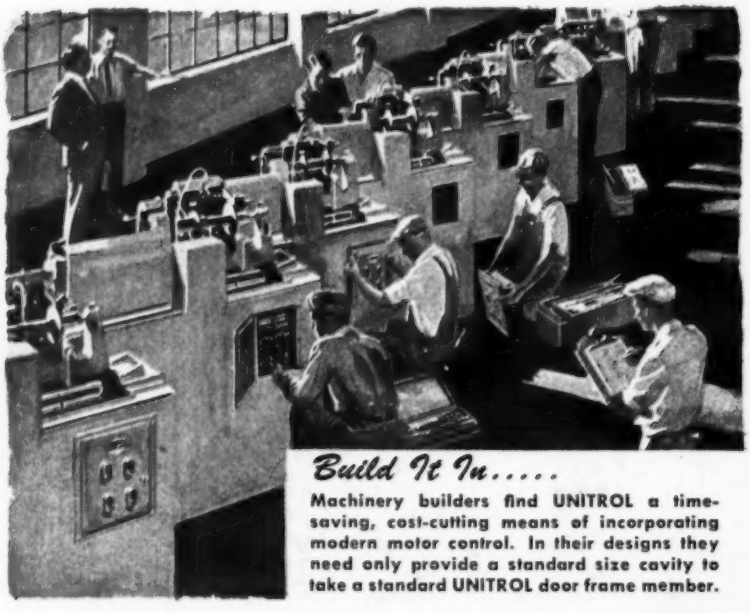

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